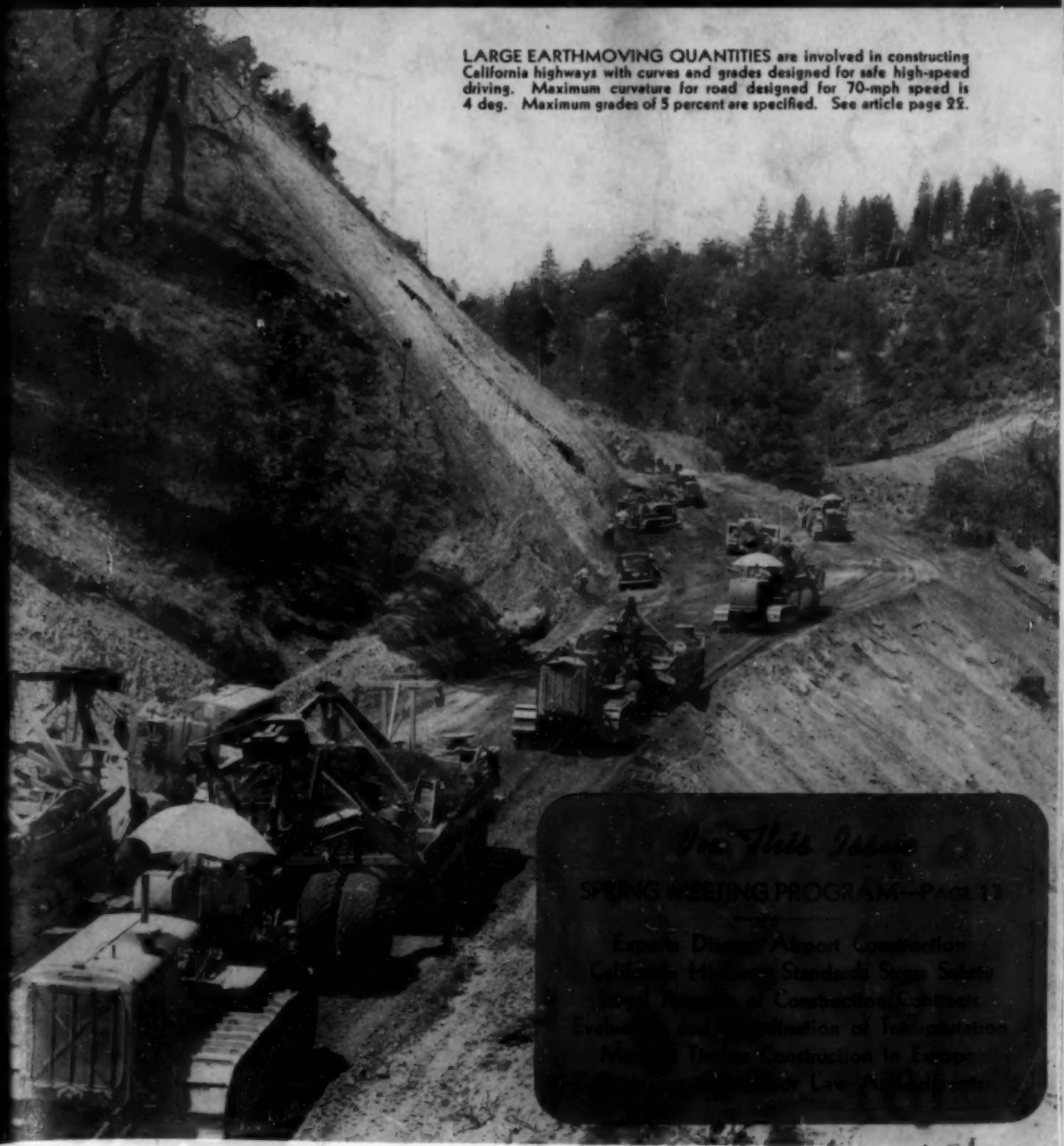
CIVIL ENGINEERING

APRIL 1947



LARGE EARTHMOVING QUANTITIES are involved in constructing California highways with curves and grades designed for safe high-speed driving. Maximum curvature for road designed for 70-mph speed is 4 deg. Maximum grades of 5 percent are specified. See article page 22.

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Evaluation and Coordination of Transportation
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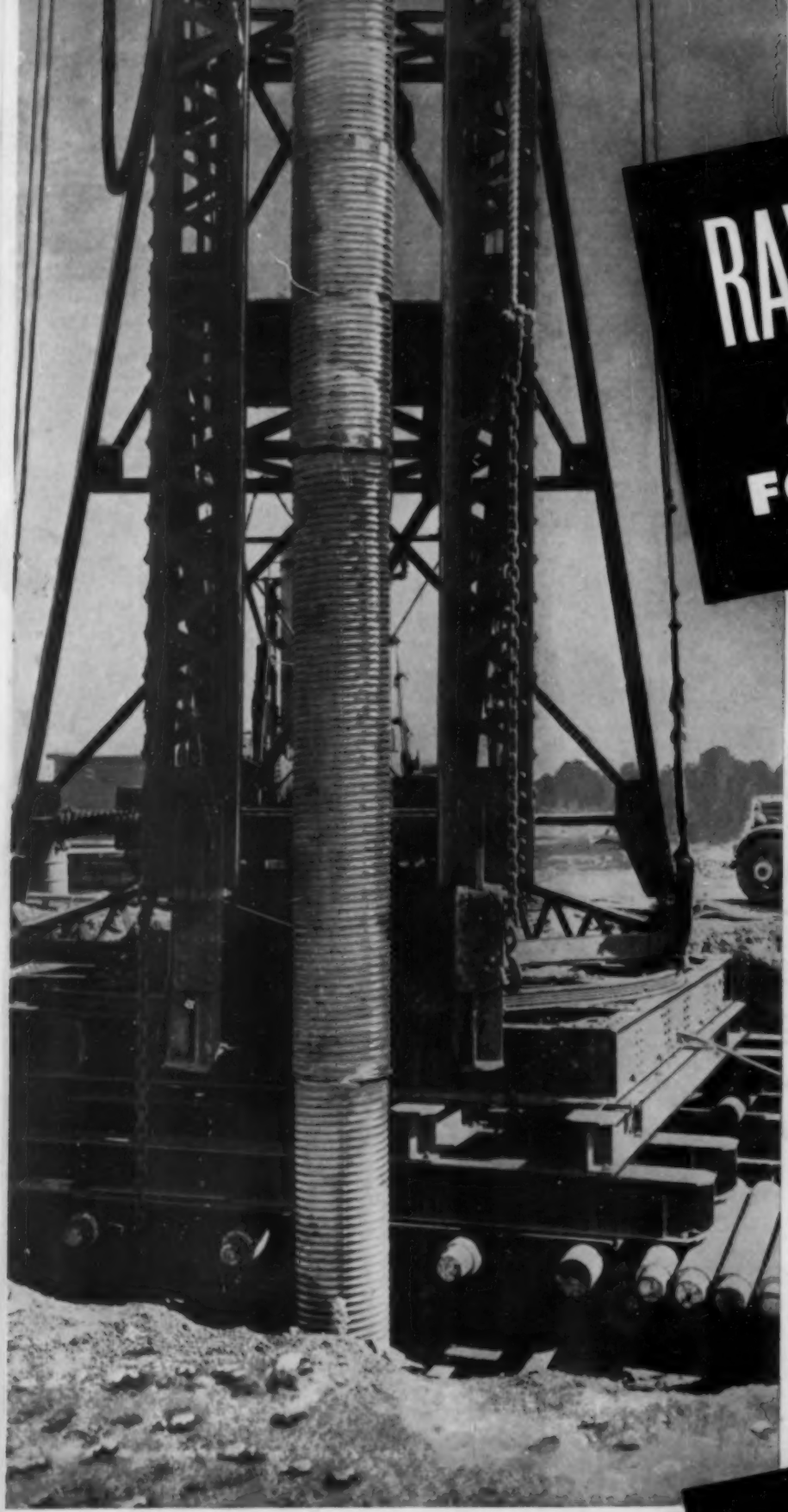
Law Articles



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APRIL 1947
Volume 17 Number 4

CIVIL ENGINEERING

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E. L. Chandler
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Walter E. Jessup
Western Representative
400 Edison Bldg.
Los Angeles 13, Calif.

PUBLICATION OFFICE
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Member Audit Bureau of Circulations

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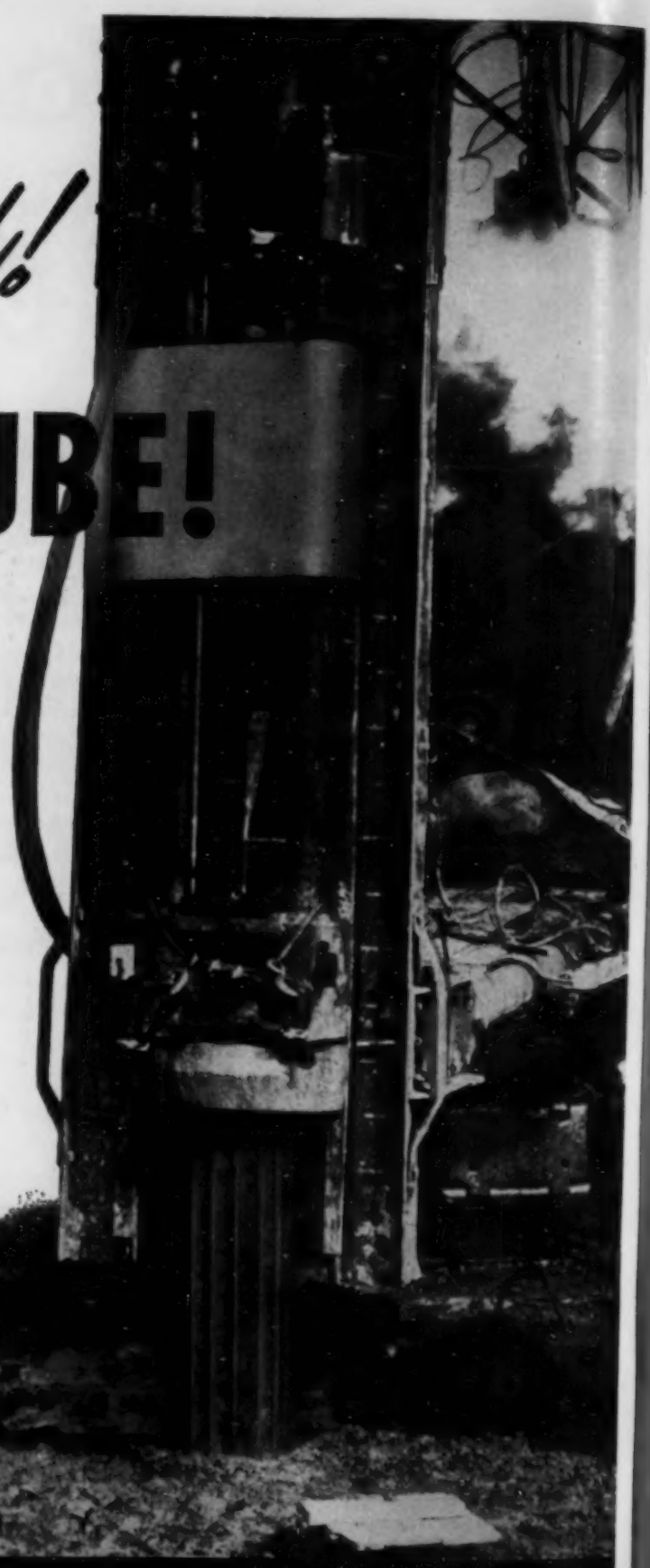
Down to earth and *in for good!* MONOTUBE!



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Check over these features—features that bring savings in time and money in constructing foundations for buildings, bridges, piers, airports, highways: Monotubes' fluted, tapered construction permits faster driving with average job equipment; Monotubes are easily extendible to any required length, right on the job; Monotubes are easy to handle, light in weight; Monotubes' tubular design permits quick checking top to toe, before concreting.

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UNION METAL

Monotube Foundation Piles

General Meeting—Wednesday Morning

9:00 Registration

FIESTA ROOM

10:00 Spring Meeting called to order by:

WALTER JOHANNESSEN, M. ASCE, President, Arizona Section ASCE.

10:10 Address of Welcome

HON. RAY BUSEY, Mayor of Phoenix.

10:30 Response

E. M. HASTINGS, President, American Society of Civil Engineers.

10:45 "What Price Water"

JOHN BOETTIGER, Publisher, *Arizona Times*.

11:15 Recess for Luncheon

12:15 Men's Lunch—Fiesta Room

Tickets $1.75 per person.

At the close of the luncheon there will be pictures of Arizona shown by Mr. E. A. Stein of Wickenburg, and a talk by Dr. Rhes Cornelius on "Atomic Energy and the Atomic Bomb."

Ladies Drive, Luncheon and Entertainment

Mrs. John Girand, Hostess

Buses leave Westward Ho Hotel at 11:15 a.m.

Lunch at the Wigwam Guest Ranch, located at Litchfield Park.

Indian entertainment following luncheon.

Tour of Tal-Wi-Wi Ranch with Members of the Dons Club as guides.

No charge for tickets.

Technical Division Sessions—Wednesday Afternoon

Highway Division

G. L. McLane, M. ASCE, District Engineer, U. S. Public Roads Administration Presiding

2:30 "Durability of Highway Substructure and Surface"

DONALD J. STEELE, Assoc. M. ASCE, Senior Highway Engineer, Public Roads Administration, San Francisco, Calif.

Discussion

3:10 "Arizona Highway Problems"

E. V. MILLER, Assoc. M. ASCE, Chief, Division of Plans, State Highway Dept., Phoenix, Ariz.

Discussion

3:50 "Freeways and Parkways"

LLOYD ALDRICH, M. ASCE, City Engineer, Bureau of Engineering, City Hall, Los Angeles, Calif.

Discussion

Irrigation Division

R. V. Leeson, M. ASCE, Assistant Engineer, Maricopa County Municipal Water Conservation District No. 1, Phoenix, Presiding

2:30 "Utilization of Colorado River Water in Arizona"

CHARLES A. CARSON, Attorney, Cunningham and Carson, Phoenix.

Discussion

3:10 "Administrative Control of Ground Water and Its Economic Effect"

HAROLD CONKLING, M. ASCE, Consulting Engineer, Los Angeles.

Discussion

3:50 "Pumping-Plant Design for the Colorado River Aqueduct"

JULIAN HINDS, M. ASCE, General Manager and Chief Engineer, Metropolitan Water District of Southern California, Los Angeles.

Discussion

Surveying and Mapping Division

G. Brooks Earnest, Chairman, Executive Committee, Surveying and Mapping Division, Presiding

2:30 "Postwar Photogrammetry"

LEON T. ELIEL, Vice-President, Fairchild Aerial Surveys, Inc., Los Angeles.

Discussion

3:10 "Future Mapping of the Public Land Surveys"

A. C. HORTON, JR., Chief Cadastral Engineer, Bureau of Land Management, Department of the Interior, Santa Fe, N. Mex.

Discussion by

FRANK W. CHAPIN, Chief Cadastral Engineer, Public Survey Office, Phoenix.

3:50 "System of Plane Coordinates for Arizona"

COMMDR. ROLAND D. HORNE, Supervisor of Southwestern District, Coast and Geodetic Survey, Los Angeles.

Discussion

4:30 "Property Surveys Must Fit the Title"

WILLIAM C. WATTLES, Chief Engineer, Title Insurance and Trust Company, Los Angeles.

Discussion

Entertainment—Wednesday Night

A Western Party Dinner with all the old-time Western trimmings will be held at the Valley of the Sun Studio. The setting will be similar to the old Western cow or mining towns, Tombstone, Ariz., being an example.

The entertainment and amusement features will be along the same lines.

Buses will start leaving the Hotel Westward Ho at 7:00 p.m.

Dinner will start at 7:30 p.m.

Tickets—$4.75 per person.

Technical Division Sessions—

THURSDAY MORNING

Construction Division

Kirby Smith, M. ASCE, Chairman, Executive Committee, Construction Division, Presiding

9:00 "Introductory Remarks"

KIRBY SMITH, M. ASCE, Raymond Concrete Pile Co., New York, N.Y.

9:10 "Construction of Davis Dam"

L. R. DOUGLASS, M. ASCE, Assistant Regional Director, Region 3, Bureau of Reclamation, Boulder City, Nev.

9:40 Discussion

9:55 "Construction of San Diego Aqueduct"

ALDEN K. FOGG, Assoc. M. ASCE, Capt. CEC, USN, San Diego, Calif.

10:25 Discussion

10:40 "Concrete Aggregate Reappraised: The Influence of Rock Properties."

R. F. BLANKS, M. ASCE, Chief, Engineering and Geological Control and Research, Bureau of Reclamation, Denver, Colo.

11:10 Discussion

Hydraulics Division

SESSIONS ON SEDIMENTATION IN RESERVOIRS

W. H. Nalder, M. ASCE, Member, Executive Committee, Hydraulics Division, Presiding.

9:00 "Opening Remarks"

C. P. VETTER, M. ASCE, Chairman, Joint Committee on Sedimentation in Reservoirs.

9:10 "Sedimentation Investigations at Conchas Reservoir"

D. C. BONDURANT, Assoc. M. ASCE, U.S. Engineer Office, Albuquerque, N. Mex.

9:40 Discussion

9:55 "Economic Effects of Reservoir Sedimentation—An Outline of the Problem"

W. E. CORFITZEN, Assoc. M. ASCE, Bureau of Reclamation, Washington, D.C.

10:25 Discussion

10:40 "Retrogression, and Its Effect on the Colorado River after Construction of Boulder Dam"

J. W. STANLEY, River Control Office, Bureau of Reclamation, Boulder City, Nev.

11:10 Discussion

NEW CONCRETE PAVEMENT on Highway 66, between Williams and Flagstaff, Ariz., typifies modern highway system of Arizona.

APACHE LAKE, with glimpses of Apache Trail road on left, is on route of those who visit Roosevelt Dam on Friday.

BARTLETT DAM on Verde River, about 30 miles northeast of Phoenix, is newest addition to irrigation system of Salt River Valley.

All Day Thursday

THURSDAY AFTERNOON

Power Division

Walter Dreyer, Member, Executive Committee, Power Division, Presiding

2:00 **Opening remarks**

WALTER DREYER, M.ASCE, Chief, Division of Civil Engineering, Pacific Gas and Electric Co., San Francisco, Calif.

2:10 **"Arizona Power Requirements"**

JOHN T. KIMBALL, Assistant to the President, Central Arizona Light and Power Co., Phoenix, Ariz.

2:55 **Discussion by**

W. W. LANE, Maricopa County Municipal Water Conservation District, Phoenix.

MALCOLM BRIDGEWATER, Arizona Power Co., Prescott, Ariz.

3:25 **"Colorado River Power Development—Past and Future"**

HARVEY F. MCPHAIL, Branch of Power Utilization, Bureau of Reclamation, Washington, D.C.

4:10 **Discussion opened by**

RAYMOND A. HILL, M. ASCE, Consulting Engineer, Los Angeles; and VAUD E. LARSON, Assoc. M. ASCE, Engineer, U.S. Bureau of Reclamation, Boulder City, Nev.

4:40 **General discussion**

Sanitary Engineering Division

R. F. Goudey, Member, Executive Committee, Sanitary Engineering Division, Presiding

2:30 **"Some Effects of Anerobic Digestion Upon Sewage Sludge"**

A. M. RAWN, M. ASCE, Chief Engineer and General Manager, Los Angeles County Sanitation Districts, Los Angeles.

Discussion opened by

DARIO TRAVAINI, Superintendent, Disposal Plant, Phoenix.

3:10 **"Colorado River Water for Domestic and Irrigation Purposes"**

G. E. ARNOLD, M. ASCE, Assistant City Manager, San Diego, Calif.

Discussion opened by

R. GAIL BAKER, City Engineer, Phoenix.

3:50 **"Engineering in Public Health"**

G. W. MARX, Assoc. M. ASCE, Director Sanitary Engineering, State Department of Health, Phoenix.

Discussion

Air Transport Division

John McGowan, Assoc. M. ASCE, Secretary, Executive Committee, Air Transport Division, Presiding

2:30 **"Factors in Airport Drainage"**

EDWARD KOEHM, Assoc. M. ASCE, U.S. Engineer Office, Los Angeles.

Discussion by

ALFRED J. RYAN, M.ASCE, Consulting Engineer, Denver, Colo., Chairman, Executive Committee, Air Transport Division.

3:10 **"The Engineer and the Airport"**

R. W. F. "BOB" SCHMIDT, Superintendent of Airports, Civil Aeronautics Administration, Santa Monica, Calif.

Discussion

3:50 **"Airport Weather Determinations and Equipment Used"**

E. L. FELTON, Meteorologist, U.S. Weather Bureau, Phoenix.

Discussion

Evening Entertainment—Thursday

H. H. Wessel, Host

Cocktail Hour—7:00

Dinner—7:30

After the cocktail hour there will be a Buffet Dinner and Dance at the Hotel Westward Ho. The dinner will consist of the usual buffet menu, plus a special table of Mexican food. The food will be served in the Patio of the hotel, followed by dancing in the Fiesta Room

Tickets $4.00 each.

Student tickets $2.00 each. If students do not desire dinner, they may attend the dancing free of charge.

Entertainment for Ladies—Thursday

Mrs. E. V. Miller, Hostess

Buses will leave the Westward Ho Hotel at 9:00 a.m. for a tour through Papago Park Botanical Gardens and Phoenix Date Farm.

The Ladies will have luncheon at Jokake Inn, winter resort in Arcadia.

Mexican entertainment following luncheon.

Visit to "Taliesin West" in Paradise Valley, winter headquarters of Frank Lloyd Wright's architectural fellowship.

Members of the Dons Club will be guides.

No charge for Tickets.

All-Day Field Trip Friday

Friday will be devoted to a field trip to Miami and Inspiration, Ariz., for a visit to the largest copper mines in Arizona. A tour of the open-pit workings and the reduction work at these mines will be made.

A barbecue lunch will be served in a Western atmosphere.

Tickets for the bus trip—$3.50 each.

Luncheon tickets—$1.00 each.

Student Conference—All Day Thursday

Continental Room—Thursday, April 24

9:00 **Registration**

10:00 **"Introductory Remarks"**

G. BROOKS EARNEST, M. ASCE, Chairman, Committee on Student Chapters.

10:10 **Welcome on behalf of ASCE**

E. M. HASTINGS, President, American Society of Civil Engineers.

10:25 **Response**

LARS HOLMQUIST, President of University of Arizona Student Chapter. Mr. Holmquist will be the presiding officer for remainder of meeting.

10:35 **"Progress in the West on Collective Bargaining for Engineers"**

WALTER E. JESSUP, M. ASCE, Assistant to the Secretary, West Coast Representative, ASCE.

10:55 **Discussion**

11:10 **"Development of Engineering Interest in Public Relations and Public Affairs"**

OSCAR H. KOCH, Director ASCE, Contact Member, Student Chapter Committee.

11:25 **Discussion**

11:30 **"Importance of Membership in the Society to the Young Engineer"**

THOMAS M. LOWE, M. ASCE, Chairman, Committee on Juniors, ASCE.

11:45 **General discussion.**

12:30 **Student Chapter Luncheon**

Tickets $1.65 each.

2:00 **Student Chapter Conference**

Papers by seven students winning Local Section awards and competing for conference prizes.

4:00 **Forum on Chapter Problems**

Discussion led by Chairman Earnest of Student Chapter Committee.

Hotel Accommodations and Announcements

Information on Hotels and Tourist Courts

HOTEL WESTWARD HO

Convention Headquarters

Rates		
	Singles	$5.00 and $6.00
	Twins	$8.00 to $11.00
	Doubles	$7.00 to $ 8.00

HOTEL ADAMS

Rates		
	Singles	$3.00 to $ 5.00
	Twins or Doubles	$5.00 to $12.00

HOTEL SAN CARLOS

Rates		
	Singles	$4.00 to $6.00
	Twins	$7.00 to $9.00
	Doubles	$6.00 to $7.00

HOTEL ARIZONA BILTMORE

(American Plan)

Rates		
	Single	$25.00 and up
	Double	$35.00 and up

HOTEL ARIZONA

Rates		
	Singles	$2.50 and $3.50
	Twin	$6.00 and $7.00
	Double	$3.50 and $5.00

MANY TOURIST COURTS

Rates	
	$5.00 for 2 persons ($4.00–$ 6.00)
	$7.00 for 4 persons ($7.00–$10.00)

Hotel Accommodations

The Hotel Westward Ho is Meeting Headquarters and a block of rooms has been reserved. It is requested that all registrations, both for rooms and tickets, be made to Mr. Leigh Gardner, Chairman of the Hotel and Registration Committee, 415 1st National Bank Building, Phoenix, Ariz.

It is the desire of the convention committee to place the registrations and inform the parties of their registration.

An early hotel registration is desired and, in order to avoid a last-minute rush for convention registrations, desks will be set up in the lounge room of convention headquarters for registration and purchase of tickets beginning Saturday, April 19. For those desiring to use the ticket order in advance, there will be no necessity for their registering at the desks as their tickets, badges and program will be sent to their room upon their arrival.

It is our hope to relieve congestion at the registration desk. An information desk will be set up in the lounge room of convention headquarters for all those desiring information regarding points of interest in Phoenix or Arizona, and trips may be arranged for parties desiring to go to Nogales, Mexico, Grand Canyon, Boulder Dam or other points that may be of interest. The information desk would be very happy to arrange such trips.

Efforts will be made to deliver telegrams and messages promptly. Any mail for members received at headquarters during the meeting will be delivered to the hotel address, if known. Otherwise, it will be held at the information desk. Letters not delivered at the close of the meeting will be forwarded to the last mailing address.

Entertainment

All entertainments during the meeting are informal and informal dress is all that is necessary. The climate in Phoenix during April precludes the necessity of bringing any heavy clothing and spring or summer garments and suits would be the most comfortable.

Local Sections Conference

The conference of representatives of Local Sections will meet at 10:00 a.m. on Monday and Tuesday, April 21 and 22, 1947, at Hotel Westward Ho. The program will schedule topics of professional rather than technical interest, in which all representatives are expected to participate. All members of the Society are welcome to attend.

Committees for 1947 Spring Meeting

Executive Committee

Walter Johannessen, Chairman

E. V. Miller — W. R. Hutchins

Hotel and Registration Committee

Leigh Gardner, Chairman
Dario Travaini, Vice-Chairman

L. R. Dail — John A. Carollo
R. Gail Baker — August Rath
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Entertainment Committee

Fred Guirey, Chairman
H. H. Wessel, Vice-Chairman

S. O. Decker — W. S. Gookin
Martin Toney

Finance Committee

E. V. Miller, Chairman
W. H. Becker, Vice-Chairman

W. L. Johnson — Claude Miller
Leon Woolsey — Vic Housholder

Transportation Committee

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R. M. Cushing — Reamy C. Fitch

Student Activities Committee

Clyde Myers, Chairman
W. L. Heckler, Vice-Chairman

W. S. Johnson — Lloyd W. Miller
Ralph L. Crull

Reception Committee

W. G. O'Harra, Chairman
Kenneth H. Talbot, Vice-Chairman

Vic Housholder — Donald Scott
Howard Reed — G. E. P. Smith
L. O. Fiscel — J. B. Girand
Arthur Pickett, Los Angeles
Ray L. Derby, Los Angeles

Technical Program Committee

John H. Gardiner, Chairman
Vaud E. Larson, Vice-Chairman

Ladies Committee

Mrs. Fred Guirey, Chairman
Mrs. H. H. Wessel, Vice-Chairman

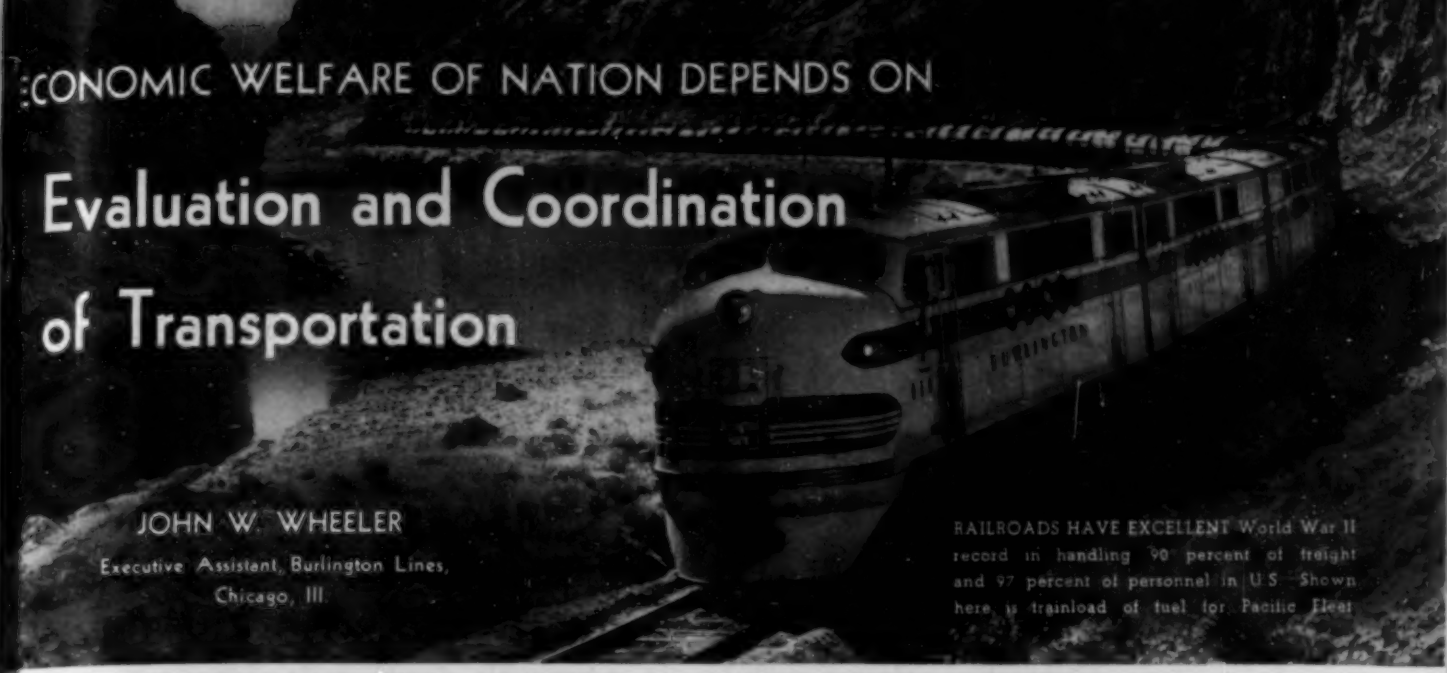
Mrs. W. Johannessen — Mrs. W. H. Coleman
Mrs. W. G. O'Harra — Mrs. G. L. McLane
Mrs. Ralph Hoffman — Mrs. Clyde Myers
Mrs. John G. Girand — Mrs. L. R. Dail
Mrs. E. V. Miller — Mrs. C. Huskison
Mrs. J. A. Carollo — Mrs. S. O. Decker
Mrs. W. H. Becker — Mrs. W. S. Gookin
Mrs. August F. Rath — Mrs. R. L. Derby, Los Angeles

ENTERTAINMENT COMMITTEE for Spring Meeting is, from left to right: Mr. and Mrs. Sherman Decker, Mr. and Mrs. William Gookin, Vice-Chairman and Mrs. Herbert H. Wessel, Chairman and Mrs. Fred M. Guirey and daughter Rogue.

ECONOMIC WELFARE OF NATION DEPENDS ON

Evaluation and Coordination of Transportation

JOHN W. WHEELER
Executive Assistant, Burlington Lines, Chicago, Ill.



RAILROADS HAVE EXCELLENT World War II record in handling 90 percent of freight and 97 percent of personnel in U.S. Shown here is trainload of fuel for Pacific Fleet

ALTHOUGH SOME ORIGINAL IDEAS have come from other lands, the United States has made the greatest progress in the development of transportation. Truly, we have come a long way, but it is high time that we study the overall transportation picture. Do we have enough? Too much? Is it efficient? Economical? Is it rapid enough? Is it satisfactory? Answers to these questions would vary, but no doubt we could all agree that coordination is needed to provide industry and the people of this nation with the best that can be had in transportation. Transportation's present-day problems, inequity of taxes among models of transportation, difficulties of devising a sound tax structure, subsidies, and government or private ownership are discussed herein.

WE MAY ASK OURSELVES: Do we have enough transportation facilities? And that answer would doubtless be a moot question. During the 30's there were many times when it appeared that we had too much transportation, and during the war years in the 40's, it appeared certain that we did not have enough. To have enough transportation to properly care for the peak, and operate economically under the peak, is a problem we face.

All forms of transportation deserve decorations for their war performance. American air transport proved itself both in this nation and in every nation on the globe. The railways rose magnificently to the occasion and handled 90 percent of the war freight and 97 percent of the war personnel in the United States. The trucking industry, in our great armament program, proved itself to be indispensable in moving war material from one fabricating plant to another, and by fast delivery, kept the manufacture of armaments in high gear. The bus industry transported the thousands of munition workers to and from their work. At a time when private motor cars and gasoline were unobtainable, it moved the personnel of our nation in an admirable manner. Pipelines played their part when our intercoastal tankers were being destroyed by the enemy, and huge new pipe lines were built to keep the all-important Atlantic seaboard supplied with fuel. Because time was of the essence in the war activity, no increase in waterborne transportation on inland waterways was necessary during the war, but much of our inland shipping equipment was moved to the coast, where it augmented transportation in the war effort.

There never again will be time for a long preparation and for mobilization if war should come—it will come suddenly and develop swiftly, without warning. The transportation industry, along with every other segment of our national economy, must be ready to act quickly.

HOW LARGE IS THE TRANSPORTATION INDUSTRY?

The transportation industry is considerably greater than is apparent from casual examination. We readily recognize the truck driver, the air pilot, and the locomotive engineer as being in the transportation industry; but the tire salesman, the filling-station attendant, highway contractor and his workman, the man cutting railroad ties in the forest, the refinery worker, workmen in automobile and railroad equipment plants, and countless more, make up the transportation industry, and added together would doubtless make this the No. 1 industry in the nation.

Changes Are Inevitable

Improvements in all forms of transportation, as we know them now, will doubtless take place in the years to come. Research and technology will give us improvements, and these improvements will be accepted. We cannot afford to be sentimental as these changes come. Doubtless, we sympathized with the manufacturer of buggy whips when his business was lost as a result of the mechanization of transportation; but he probably turned his talent to the manufacture of spark plugs and made considerably more money. Time marches on in transportation, perhaps more than in any other phase of our industrial life.

All Transportation Assisted by Government

The young and virile United States Government, through the years, has been ready to assist financially the different branches of transportation as they have presented themselves in their infant stage and showed need for such assistance. The early turnpikes and canal boats were helped, but regardless of this help, each one failed because of the development of a newer form of transport. Railways were subsidized in the early days by land grants, which they contend they paid for a hundred times over before they were relieved of the land grant rates in this present year.

Highways were and are assisted by federal funds, and because of this, a great system has been built. Airways have been assisted financially with public funds by the building of terminals, as well as the lighting of emergency fields and the operation of weather and meteorological stations.

PAN-AMERICAN CLIPPER exemplifies commercial airlines which, in many cases during World War II, carried U.S. flag in advance of our armed forces.

Inland waterways have been assisted by the expenditure of public funds in the way of deepening of channels and maintaining them in a navigable condition, to the extent of dams to insure usable water stages, and by the construction of terminals. Until World War II, the pipeline interests could probably say that they have received no assistance and have stood squarely on their own feet. However, some public money was used during the recent war in building of pipelines.

Probably no single subject in the transportation field becomes as controversial as that of public funds spent in the assistance of the different branches of transportation, and probably nothing is as poorly understood as the term "public funds." Treatment of public funds will be discussed later in this paper, but first, regulation and taxation of the present form of transport will be discussed. Our most current sources of information on these subjects are a report by Dr. William J. Cunningham, professor of transportation, emeritus, Harvard University Graduate School of Business Administration, and Col. J. Monroe Johnson, Office of Defense Transportation, in his answer to an inquiry from Congress on the National Transportation Policy. For brevity, we will refer subsequently to the first as the Harvard Report, and to the second as the ODT Report.

Taxation of Different Forms of Transportation

On the subject of taxation of different forms of transportation, the Harvard Report reads as follows:

"The question of equity of taxation is a difficult one in any field. It is particularly vexatious in connection with the transportation agencies because of the fact that some of them use government-owned property not subject to taxation while others, principally the railroads, do not have that opportunity.

"Inequity of Taxes Among Modes of Transportation: The payments made by highway users in gasoline taxes, registration fees, drivers' licenses, and the like, may not properly be regarded as taxation. They are really charges for the use of publicly owned highways. Such collections do not go into the funds for the general expenses of government; rather they are earmarked for highway construction, maintenance, policing, and other such costs directly beneficial to the motor carriers' activities. Furthermore, such user charges paid by the commercial motor carriers using heavier vehicles, as will be shown later, do not compensate the government fully for costs—maintenance, amortization, and interest. The water carriers pay nothing (except in the Panama Canal) to compensate the government for its large expenditures in making the waterways suitable for navigation. Nor do the airlines pay anything for the lighted airways, radio beams, and weather service (beyond gasoline taxes, which amounted in 1940 to only about $1.3 million); and they pay less than costs for the use of airfields. The railroads, on the other hand, own and maintain their roadways and structures, which comprise about 70 percent of their total investment, and pay ad valorem taxes on such property. The pipelines are the only other agency paying similar taxes.

"All the taxes paid by the railroads are devoted to general governmental purposes such as the support of schools and courts, fire and police protection, and other general costs. Part is even used to cover the costs of aids to air carriers, and, in those states where the total collections from motor vehicles in gasoline taxes and other charges are less than the cost of providing and maintaining the highways, some of the money contributed by the railroads as taxpayers is used to subsidize their motor competitors. The only contributions made by motor carriers to general governmental expenses are the taxes paid on the motor vehicles and privately owned property, such as terminal buildings, garages, and other such facilities; excise taxes on certain materials; and income and excess profits taxes. Similar observations can be made of water and air carriers. These contributions are relatively small. In any event, the railroads pay all such taxes too, in addition to their ad valorem taxes. And, as a last but not insignificant factor, the rate at which the railroads are taxed for employee retirement is substantially higher than that applying to other forms of transportation.

"Difficulties of Devising a Sound Tax Structure: The task of devising a basis for transportation taxation which would be reasonable in total and equitable in distribution among the several agencies of transportation is extremely difficult, partly because so many governmental taxing agencies are involved—the federal government, the states, and the municipalities, townships, and counties. The problem is more, however, than simply one of imposing adequate user charges. Certainly each agency of transportation should assume not only its fair share of the cost of providing and maintaining the government-owned facilities it uses but its fair share of the general cost of government as well.

"But what basis can be used? The one common denominator among those who conduct commercial transportation is gross revenue. There is merit in the relatively simple suggestion that apart from income, excess profit, and excise taxes, which are collected by the federal government, and used to finance the cost of the federal government, the taxation by states and other units of local government should be in the

Following each war since 1776, a new transportation era was ushered in and greater progress made. After the Revolutionary War came the era of the turnpike and plank roads through the wilderness, assisted by the federal government. After the War of 1812 came the canals with their towpaths and mules. After the Civil War came the railroad era. After World War I came the great highway era and the beginning of air transport. World War II has so recently concluded that it is difficult to assign any new form of transportation to the coming years. However, great progress can be expected from all present forms.

BUS SERVING WORKERS at Willow Run plant, Detroit, Mich., is reminder of exemplary wartime job of bus industry in transporting thousands of munitions workers.

form of a tax on gross revenues (or on a combination of gross and of net revenues after payment of operating expenses exclusive of taxes) and that such a tax should be levied uniformly on all forms of commercial transportation."

Also, on taxation, the ODT Report says:

"It would appear that, under existing conditions, the railway is, in comparison to other types of transport, unduly burdened by policies of taxation in effect. The tax burden of the air lines is comparatively light, and the same is true with respect to domestic water transport. While highway interests protest vigorously against what they allege to be the heavy tax burden resting upon that industry, distinction is rarely made by the protestants between the *user* charge properly assessed against commercial highway operators through various imposts, and an actual tax. Indeed, the current movement which seems to have gained considerable acceptance, to prohibit the "diversion" of revenues from highway users to other than highway purposes will exempt in certain jurisdictions the highway operator from the payment of any genuine tax, if tax be interpreted as a charge made to aid in meeting the general costs of government.

"The railways, owning not only their equipment, but also the right-of-way over which they operate, are highly vulnerable to heavy tax charges. Despite the fact that the railways have been subject to taxation by the various states for more than a century, no uniform basis of taxing has yet been developed; on the contrary, it would be difficult to find any two states which proceed upon the same basis or give the same weight to particular elements of value. Furthermore, these evaluations do not remain constant; rather, they tend to change with changes in the state administration. I [Colonel Johnson] think there is little doubt but that, among the various forms of domestic transport, the tax burden of the railways is the most onerous.

"Short of federal interference upon the ground that the tax policy of a particular state prejudices interstate commerce, there seems to be no remedy that can be effectively applied by Congress or by any federal regulatory authority. Such interference should occur only as a last resort, after every attempt at negotiation has failed. It might be desirable for the Interstate Commerce Commission, perhaps at the instance of Congress, to father an interstate conference upon carrier taxation; this conference could work for a time upon the problem of developing greater uniformity among states, then close; on the other hand, it might be more desirable to have this conference a continuing body, the Interstate Commerce Commission seeking through it to obtain greater uniformity and to minimize abuse."

Public Subsidies

On this subject the Harvard Report reads as follows:

"The public aid given to the several modes of transportation has differed in kind and, more important, has been unequal in degree. From today's view some of these aids are of the past and only of interest historically; others are of the present and of current interest. In the case of the aids to railroads, they were entirely for common carrier transportation. The aids to highways, waterways, and airways were also primarily for commercial transportation, but they were and are of benefit also to private operators of motor vehicles, watercraft, and airplanes. In such cases of joint benefit, the interests affected usually disagree over the bases of allocation; the whole subject of subsidies to transportation is controversial."

The Harvard Report states further that the framers of the Transportation Act of 1940 adopted the recommendation made by the late Joseph B. Eastman when he was Federal Coordinator of Transportation (1933–1936) in authorizing the creation of a temporary Board of Investigation and Research (BIR). Among other things, BIR was directed "to investi-

REGULATIONS OF DIFFERENT FORMS OF TRANSPORTATION

1. Railroads—Regulated as to interstate commerce by the Interstate Commerce Commission chiefly under the Interstate Commerce Act, but also under a large number of other statutes, such as the Clayton Act, Safety Appliances Acts, etc. Although railroads are regulated by the Interstate Commerce Commission, at the moment certain roads are being taken to court by the Department of Justice for violation of the Sherman Anti-Trust Law.

2. Pipelines—Pipelines, except gas and water, are regulated under Part 1 of the Interstate Commerce Act. Gas pipelines are regulated by the Federal Power Commission. If pipelines are able to shift from liquid products to gas from time to time, regulation would likewise have to be shifted.

3. Highways—Interstate, common carrier, and contract trucks and buses are regulated by the Interstate Commerce Commission under Part 2 of the Interstate Commerce Act.

4. Airlines—Commercial airlines are regulated by the Civil Aeronautics Board under the Civil Aeronautics Act of 1938, in so far as certificates, franchises, routes, etc., are concerned, and regulated by the Civil Aeronautics Authority in so far as safety requirements are concerned; also by the Civil Aeronautics Authority as to physical operation.

5. Waterways—Domestic transportation regulated by the Interstate Commerce Commission under Part 3 of the Interstate Commerce Act. However, the streams on which waterway transportation operates are improved and maintained by the federal government through the Corps of Engineers, which Corps recommends as to convenience and necessity to Congress.

RED BALL TRUCKS, which supplied our forces in drive across France, unload supply of high-octane gasoline at advance airfield. Like railroads, truck industry has excellent World War II record in foreign theaters of operation.

gate the extent to which right-of-way and other transportation services have been or are provided from public funds for the use . . . of each of the three types of carriers (by rail, highway and water) without adequate compensation, direct or indirect, therefor, and the extent to which such carriers have been or are aided by donations of public property, payments from public funds in excess of adequate compensation for services rendered in return therefor, or extensions of government credit." (The Board later expanded its studies to include air carriers.)

The BIR report submitted to Congress on September 18, 1944, the day on which the life of the Board expired, is too lengthy to include in this paper in full, but its recommendation is quoted as follows:

"It should be the aim of public policy in promoting each kind of domestic transportation, where expenditures of public funds are involved, to seek the development of each type in its relationship to an economical and adequate system of domestic transportation, with due regard for the effects of such expenditures on the transportation system as a whole."

Cheap or Economical Transportation?

We want rapid transportation and economical transportation, but there is a marked difference between economical transportation and cheap transportation. We have had cheap transportation, particularly in 1946, when the cost of transportation remained at the low level of former years, while at the same time other prices advanced. It is quite evident that this cheap transportation could not long remain economical transportation.

Because time has not permitted completion of official reports of the year, we must use unofficial reports, one of which shows that 1946 was a paradox for the airlines in that they transported more passengers than ever before, with only about half of the lines showing any profits. Such conditions cannot continue and give us the safe, dependable air transportation which we desire and expect. A statement from the railroads is similar. It sets forth that the railroads of the United States in 1946 handled the greatest volume of traffic of any peacetime year, but their net earnings were little better than those of the depression years that preceded World War II. Having in mind better passenger service on the rails, as well as freight, which necessitates new and better equipment and track, it is apparent from the long-range viewpoint that this was cheap transportation, rather than economical.

America's trucking industry handled a heavier volume of freight in 1946 than in the war years of 1944 and 1945. Although final compilation of truck-loading reports for the last two months of 1946 were not available when this paper was written, estimates indicate a near-record tonnage, approaching if not equaling the all-time high of 1943. Last year (1946) was the first on record in which the ATA truck-loading index figure, computed on the basis of the average monthly tonnage of the reporting carriers for the three-year period 1938–1940 as representing 100, has topped the 200 mark more than once in a single year. This index reached 204 in both August and October. Net earnings of motor carriers also improved considerably from the "near-disastrous" year of 1945. However, the revenue of truck operators in that year was so low that the improvement in 1946 did not place many motor carriers on a sound financial basis.

Government Versus Private Ownership

A method is needed whereby transportation can be economically coordinated and yet remain in private industry. This can be attested by the experience from two wars. In World War I, the government took over the railroads and the venture cost the government one billion 600 million dollars, while in World War II the railroads remained in private industry and paid the government during the war years 4 billion 600 million dollars.

Another situation we may well watch is that of government-owned and privately owned industry in England at the moment. At the annual meeting of the American Association of State Highway Officials in Los Angeles, December 1946, Thomas H. MacDonald, Commissioner of the Public Roads Administration, raised a question as to whether planning surveys should not take into account forms of transportation other than by highway. England, he said, has just enacted a law which nationalizes all forms of transportation, protecting railroad income by limiting common-carrier motor trucks to hauls within a 25-mile radius, and private trucks to 40-mile hauls.

Coordination Needed

On coordination, Maj. Gen. Edmond H. Leavey, Chief of Transportation, says: "Within the high levels of prosecuting the war there was clearly defined coordination of military and civilian transportation. The Office of Defense Transportation, the Association of American Railroads, port authorities, and innumerable other organizations and activities were tied into the complete transportation picture. The war taught us many lessons in transportation, but probably none so important as the fact that mutually helpful coordination throughout the

entire field of endeavor played a decisive role in attaining the unprecedented accomplishments properly accredited to transportation."

Col. J. Monroe Johnson, ODT, recently stated that a Department of Transportation in the President's cabinet is necessary to coordinate the nation's transportation.

The New York *Journal of Commerce* on January 2, 1947, published the statement that the House group will hear all sides in fixing U.S. transport policy. The House Interstate and Foreign Commerce Committee in the new Congress will hold hearings on views obtained in its national transportation policy inquiry to develop legislative proposals fair to all competing agencies of

(*Continued on page 74*)

Ratchet Lever Hoists Straighten Tilted Bridge

FLOOD WATERS ATTACKING the piers of a highway bridge over Coal Creek in Fountain County, Indiana, undermined the upstream end of one pier and caused it to settle about 30 in., thus throwing the whole bridge out of alignment. Although the pier reached firm footing in its new position, the two bridge spans stood at such an angle that county road authorities had to condemn the structure.

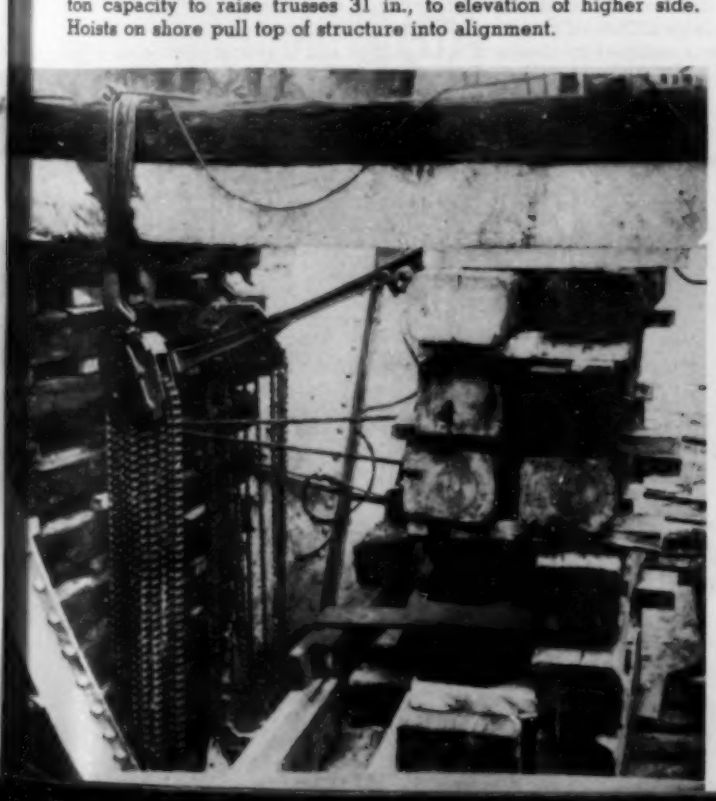
Consultation with contractors showed it impractical to raise the bridge by use of screw-jack and cribbing, because of the constant danger that freshets would wash away the cribbing and allow the bridge to topple. Cost to the county of removing the bridge and replacing the pier was estimated at about $40,000. However, two county residents, Homer and J. D. Coffing, brothers of F. W. Coffing, inventor and manufacturer of the Coffing "Safety-Pull' ratchet lever hoists, conceived the idea of pulling the bridge back into position with four such hoists—two Model WG, of 15-ton capacity and two Model ZG, of 6-ton capacity.

Enough of the flooring was removed to build 7½ ft of cribbing on both sides of the bridge girders atop the tilted pier, on the low side of the bridge, as shown in the photograph below, left. The two 15-ton-capacity hoists were suspended from the cribbing and attached to the ends of the 125-ft trusses. By operating the hoists simultaneously, the entire bridge structure was kept in balance while being raised. The two 6-ton-capacity hoists were attached to shore anchors some 200 ft from the bridge, with cables running to the top of the structure to permit pulling the top of the frame back into alignment at the same time that it was being raised from the pier.

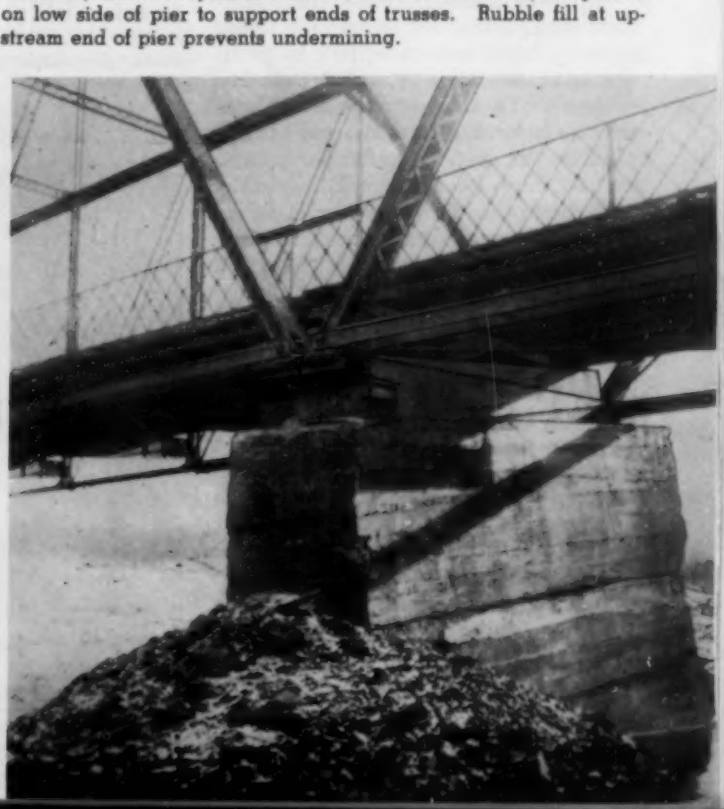
After the truss ends had been raised some 31 in. on the low side, two 16-in. steel I-beams 5 ft long were placed crosswise on the low end of the pier, where the truss ends formerly rested. See photograph below, right. The I-beams were placed 24 in. apart and tied across their ends with 1-in. bolts. When headers had been placed over the open ends, the section between the beams was filled with concrete. Two layers of 6-in. I-beams were placed crosswise over the concrete-filled beams, and ½-in. sheet steel was added to build the pier section to the required height of 30 in. Rollers were then placed under each span on 1-in. sheet steel. When weather conditions permit, a concrete and steel form will be built around the blocking and across the pier to give additional support.

Advantages of raising the bridge by this method were: (1) The entire cost was less than $1,000, including rubble filling around the bottom of the pier to prevent further washing. (2) The job was done by six men in less than two days, including straightening of the entire bridge frame. (3) The workmen were in less danger because they were always on top of the bridge, and much heavy labor was saved. (4) The bridge was balanced at all times with no danger of toppling.

CRIBBING PLACED ON TOP of tilted pier, both inside and outside of girders on low side of bridge, enables two ratchet hoists of 15-ton capacity to raise trusses 31 in., to elevation of higher side. Hoists on shore pull top of structure into alignment.



FOLLOWING LIFTING OPERATION, two 16-in. I-beams filled with concrete, and two layers of 6-in. I-beams laid crosswise, are placed on low side of pier to support ends of trusses. Rubble fill at upstream end of pier prevents undermining.



Standards for Adequate California Highway System Stress Safety of Operation

G. DONALD KENNEDY, M. ASCE
Vice-President, Automotive Safety Foundation, Washington, D.C.

TECHNICALLY CORRECT and practically sound design standards have administrative value as the basis for determining the ultimate cost of a road system, for insuring a balanced program between systems and between jurisdictions, and as a means of deciding priority of road improvement. National standards make available to all road builders the latest policies and practices developed through research and experience of the engineering profession. This study of the major elements of road design standards calls attention to the complexity of engineering problems involved in highway construction, to show how public funds are used to build safety and service into road facilities, and to make clear that the sacrifice of any element of design will affect safety and the service ultimately rendered.

NATIONAL STANDARDS have been formulated over a period of years through the cooperative efforts of the Public Roads Administration and the American Association of State Highway Officials. The objective is to pool the technical progress made by all agencies to insure uniform levels of development. The federal road agency carries on research projects set up by committees of the Association, and findings are reviewed and supplemented until acceptable policies are evolved. Leading engineers in state highway departments make up the personnel of the committees.

Separate standards for the interstate system and for secondary roads recently have been adopted, in addition to standards for the state primary systems. These standards are obligatory on federal-aid routes, and are applied by the states to other roads in so far as may be financially feasible. Adoption of such sets of standards insures that improvements will be adequate to meet demands made on each system.

Standards for Counties and Cities

Some states have adopted standards for county roads and city streets, but in California this has been left to the individual jurisdictions, except where the use of federal funds is concerned. A number of California counties and cities, following the best engineering advice, have adopted the latest nationally accepted design practices and it is desirable that such uniform standards apply to all county and city systems.

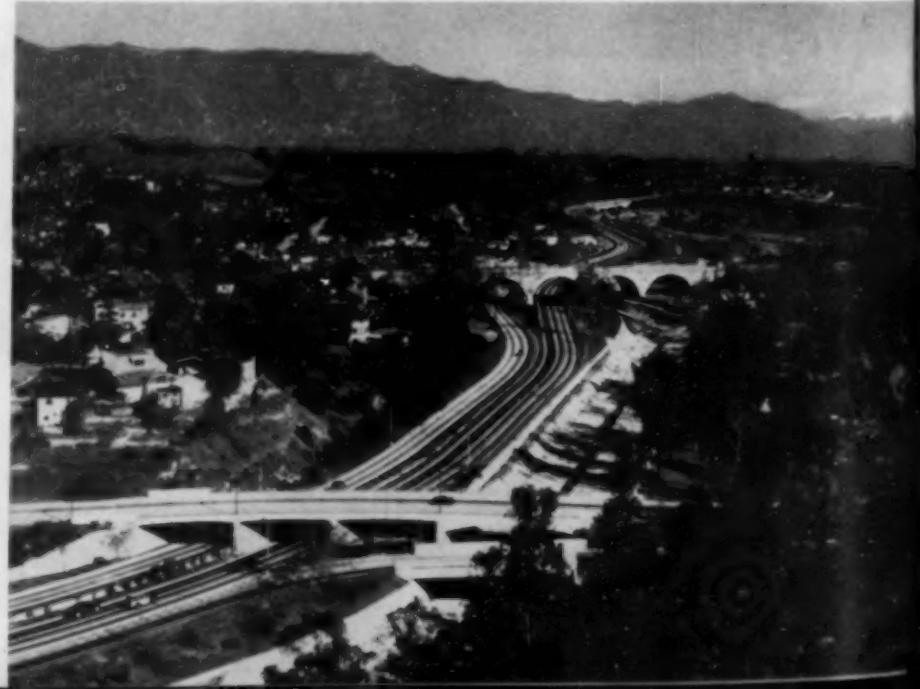
Geometric design deals with the width and horizontal or vertical alignment of a road, and structural design relates to the weight-carrying ability and stability of roadways, based on the nature, thickness and manner of placement of the material used. Safety is a predominant consideration in geometric design and also affects structural design.

The three fundamental considerations in determining the design of a road are the number of vehicles to be accommodated during peak hours of traffic, the types of vehicles that will use the road, and the speed at which they may safely operate.

Projections of future traffic may show that during the anticipated life of a road more lanes will be required than immediate conditions demand. In such case provision must be made for location and right-of-way to allow for later expansion. Stage construction or partial improvement may be used before building to ultimate standards if such investment can be salvaged in the final product.

A thorough study of California highways has shown that it is vitally necessary to convert many two-lane roads to four-lane divided highways. The point in traffic volume at which this improvement should take place to eliminate congestion and resulting accidents is of particular importance. California highways carry relatively high volumes of traffic per mile, which makes the need for additional lanes greater than in most states. California state highways now have 1,115 miles of two-lane road which needs immediate conversion to four lanes of divided highway. By 1960, an additional 850 miles will require reconstruction to four-lane divided highway.

DIVISION OF ALL FOUR-LANE HIGHWAYS into two one-way pavements is justified on grounds of safety and increased flexibility and efficiency in movement of traffic. Dividing streams of traffic eliminates almost all head-on collisions—one of most serious types of accidents. Headlight glare is reduced by narrow dividing strips and is almost eliminated when strips are wide.



IMPORTANT ELEMENT of highway design is treatment of intersections. In 1945, 41.6 percent of all California highway accidents occurred at intersections. Three principal design types are: (1) Intersections at grade, where one stream of traffic crosses another; (2) rotary intersections, where vehicles converging at the point of crossing enter a traffic circle which merges with main flow; and grade separations which physically divide opposing streams of traffic by means of underpasses and overpasses. Type of intersection is determined on basis of anticipated amounts and types of movement and degree of hazard involved at crossing.

To determine the exact necessity for additional lanes, all elements of topography and potential use characteristics must be considered but, in general, when the annual daily traffic averages 5,000 vehicles, a two-lane road should be improved to four lanes.

Divided Highway Recommended

The superiority of divided highways is particularly evident at grade intersections. Pedestrians and drivers crossing such roads need to watch traffic in only one direction at a time. If the dividing strip is wide enough, vehicles making left turns onto or off the highway can slow down or stop between roads to take advantage of breaks in traffic.

Lanes must be wide enough to provide lateral maneuvering space for all types of vehicles operating at speeds for which a road is designed. For passenger-car traffic at normal operating speeds, 11-ft lanes in rural areas are adequate. On rural roads carrying a high percentage of commercial vehicles, 12 ft is the standard. Eleven-foot lanes are adequate in urban areas except on the expressways and freeways, where 12 ft is recommended.

National standards for the interstate system prescribe 12-ft lanes where traffic density at the 30th highest hour of the year exceeds 200 vehicles per hour, with 11 ft for lesser volumes. The AASHO recommends 11-ft lanes for all other roads having volumes between 100 and 200 vehicles per hour where the design speed is 50 mph or more. Lanes as narrow as 10 ft may be used on roads expected to carry less than 100 vehicles per hour with a design speed of less than 50 mph.

National standards for the interstate system provide for design speeds ranging from 70 mph in level country to 50 mph in mountainous sections, and 50 mph on urban routes.

On state trunklines and county roads, when traffic exceeds 100 vehicles per hour and operating speeds are lower, the recommended minimum design speeds range from 60 to 40 mph, depending on the amount and character of traffic, economic feasibility and topography. When traffic is less than 100 vehicles per hour, the minimum design speed ranges from 40 down to 25 mph and the desirable design speed from 50 to 30 mph.

Sight Distance Important

Adequate sight distance is required for overtaking and passing vehicles and for safe stopping in case of an emergency or an obstruction on the highway. For a road with a design speed of 70 mph, the recommended standard for sight distance necessary for overtaking and passing is 2,600 ft. This distance is scaled down to 600 ft when the design speed is as low as 30 mph.

Sight distance for safe stopping is the number of feet between a vehicle and an obstruction in which the vehicle may be brought to a halt to avoid an accident. Recommended standards vary from 475 to 200 ft, depending on the design speed of the road. Sight distances on California highways should in no case be less than the national standards, because brake tests indicate that the national standards may be too low. High speeds are normal in California because of the high proportion of long trips, so particular attention must be paid to providing safe stopping distance.

It is essential that a highway have shoulders of adequate width to provide emergency parking space and room to maneuver if critical traffic situations develop. Shoulders contribute to ease of driving by giving added visibility of the road ahead and a feeling of safety. Standards for the interstate system call for 10-ft shoulders except in mountainous sections where, in the interest of economy, they may be reduced to a minimum of 4 ft. On routes other than expressways, 8-ft shoulders may be used in cuts, with 10 ft in fills. In urban areas, shoulders should be 10 ft wide where trucks are to be parked, otherwise 8 ft. The use of 10-ft shoulders must be controlled to prevent their use as traffic lanes.

Standards also are set to limit the steepness of highway grades. For the interstate system 5 percent grades are the general limit with a maximum of 6 percent, except that on very short grades 7 percent may be permitted. On routes other than state highways, exceptions may be made in accordance with standards adopted for the federal-aid secondary system. Maximum grades of 5 percent are specified because they do not interfere with flexible operation of passenger cars.

STATEMENTS BY Gov. Earl Warren—before an extraordinary session of the California Legislature—calling for remedial action in California's highway setup are given in an item titled, "California Legislature Studies Highway Safety," page 64 of this issue.

CALIFORNIA STATE Division of Highways is designing all new bridges to standard H20-S16 loading to accommodate maximum legal loads, as well as all types of military vehicles, without serious overstress.

Type of intersection is determined on the basis of anticipated amounts and types of movement and the degree of hazard involved at the crossing. Provision must be made for adequate sight distance, protection and guidance of all turning movements, and separation of vehicular and pedestrian traffic. The usefulness and safety of any type of intersection depends to a great extent upon the placing of adequate signs and other traffic devices to guide traffic in the proper direction.

National standards, which are recommended for the state expressway system, provide for grade separations where 3,000 or more vehicles use the road at the 30th highest hour of the year. Other intersections must have appropriate controls or physical layout to meet traffic requirements.

Structural Design

Pavement may be of the flexible or the rigid type. In a flexible pavement the support of the load comes principally from the subgrade soil and supporting material under a relatively thin wearing surface of bituminous material, while a rigid pavement consists of a thicker slab of solid material such as portland cement concrete. Pavement type is primarily determined by the quality of the available supporting subgrade materials.

Bridge design loading is controlled by the total weight of vehicle loads as well as the number, spacing and frequency of axle loads. Bridges are classified in general as H-10, H-15, H-20 and H20-S16 loadings. These designations are based on conditions brought about by groups of vehicles crossing a bridge in a single lane. For example, the H-20 design assumes a train of vehicles consisting of one 20-ton truck preceded and followed at normal spacing by 15-ton trucks. H-10 design assumes a 10-ton truck preceded and followed by $7\frac{1}{2}$-ton trucks, and H20-S16 design would accommodate a 20-ton truck and 16-ton trailer followed by correspondingly lighter vehicles.

Limitations on vehicle design and load must be imposed. Continued overloading beyond design standards will shorten the life of the structures. Standards for the interstate system provide for H20-S16 bridge design, and this standard should be used on the state expressway system and on other routes in California expected to carry maximum legal loads. Other roads require designs comparable to anticipated loadings.

Design standards now required to accommodate legal loads in California constitute a serious problem. For example, on the state highway system which has 4,424 bridges, only 346 are of H-20 design. There are 2,059 of steel or concrete construction, 1,117 wooden structures of H-15 design, and 902 built to lower standards. Bridges on county roads are greater in number and perhaps weaker in capacity. Military vehicles of the heavier classes require the modern H20-S16 bridge design.

In the proposed state expressway system, design standards must be high enough to accommodate all types of vehicles that will constitute the traffic over the system. It is contemplated that trucks will be operated on all units of the expressway system, and buses on most routes. It is essential that bus routes be determined before expressways are designed, because special provision must be made for the safety of bus passengers and the general traffic, with facilities for loading and unloading passengers outside the traffic lanes. Such facilities must be designed into the system because of the impracticability of adding them after the highway is constructed.

Bus lines operating over expressways properly designed to handle such traffic will add materially to the state's highway transportation facilities and serve large numbers of people who must rely on mass transportation.

In the case of metropolitan freeways which are not part of the state expressway system, the decision as to the operation of trucks and buses should be made by the appropriate local authorities.

DANGEROUS THREE-LANE, two-way-traffic highways will give way to safer multiple-lane expressways under new standards of road improvement recommended to California Legislature. New highways are to be constructed to physical standards that result in reasonable balance between performance ability of drivers and operating characteristics of vehicles to attain safe, efficient and economical transportation.

Vehicle Dimensions

Vehicles in California are limited to a width of 96 in., with exceptions granted for special-purpose vehicles operating on selected sections of highway. Width limitation is necessary because, along with speed, it is a factor in determining the width of road lanes.

Desirable standards for lane width have been set with variations from 10 ft for lower-volume and low-speed-design roads to 12 ft for high-speed, high-volume roads. Approximately half of the rural state highway mileage in California has a surface width of less than 22 ft; therefore it would be inadvisable at present to permit a vehicle width greater than 96 in. In 1937 the county road system had a

width of less than 20 ft on 53 percent of the surfaced mileage.

There is a demand by bus and truck owners and manufacturers for an increased width of 6 to 8 in. In California, motor coaches or buses operated as common carriers may have a maximum outside width of 104 in. under special conditions.

It is recommended that lane widths of 12 ft should be provided on all main routes to accommodate existing legal-size vehicles. Safety and highway capacity will be jeopardized by permitting vehicles of greater width to operate until a sufficient mileage is of adequate width. The adopted national standards recommend: "The State Highway and the Public Roads Administration are urged to give consideration to the desirability of eventual provision for the accommodation of vehicles 102 in. in width in planning the reconstruction of federal-aid and state highways."

The maximum height of vehicles has been established in California as $13\frac{1}{2}$ ft, which is 1 ft greater than the recommended national standard. This appears to be adequate to meet future requirements of highway users.

Motor-Vehicle Wheel Loads

The load carried on a single axle is limited to 18,000 lb by national standards, with a maximum of 32,000 lb for dual axles spaced less than 8 ft apart. These limits are set on the basis of the effect of weight upon the pavement. Requests have been made for greater axle loads, but studies made of the effects upon road surfaces indicate that an increase in allowable wheel loads of 25 percent would require a corresponding increase in pavement thickness of 10 percent for rigid types and 15 percent for flexible surfaces. The additional cost appears to be unjustified on the basis of benefits that would be derived.

California roads now are designed to carry four tires per axle with each tire carrying 5,000 lb, which is equivalent to an 18,000-lb axle load. Roads are being built today to last for many years. If heavier loads are to be permitted in the life of the roadway, it must be known now.

Heavier wheel loads also would tend to increase total vehicle loads, which would have a serious effect on the capacity of structures. It appears that the financial burden of modernizing the present highway system to carry existing legal weight limits will be sufficiently heavy without permitting higher load capacity for trucks and buses.

Because of the fact that vehicles differ in size, weight and operating characteristics, numerous attempts have been made to determine the effects of the operation of the various types on the costs of providing roads to meet their specific requirements. The number of trucks operating on a road affects the number of lanes required to the highest degree when traffic approaches a volume at which it normally becomes necessary to add more lanes. A two-lane road in level topography will carry a maximum of 600 passenger cars per hour at an operating speed of 50 mph. If 10 percent of the traffic consists of commercial vehicles, the road will carry only 550 per hour, and if there are 20 percent commercial vehicles the capacity is 500 per hour. Because of this decreased capacity, multiple-lane roads are required sooner than when passenger cars only use the road.

ELIMINATION OF ALL RAILROAD GRADE CROSSINGS is manifestly impossible, but it is highly desirable to separate highways and rail lines at more heavily traveled points. There is no exact formula for determining when separations are warranted but consideration must be given to accident records, accident potentials and evaluation of time losses.

Truck Performance Considered

Truck performance studies have shown that operating conditions are best when maximum advantage may be taken of truck momentum. Thus short, rolling grades permit trucks to operate with the least reduction in average speed. When sustained grades are necessary, the effect on truck operation is the total amount of rise to be accomplished. There is relatively little difference in truck operation, as far as average speed is concerned, whether the grade is 4 percent or 6 percent. The truck must shift to a lower gear in either case, and there is no decided advantage in engineers' attempting to reduce a grade from 5 percent to 4 percent to benefit trucks.

Automobiles operate satisfactorily on grades not exceeding 5 percent, which is far in excess of any gradient suitable to optimum truck operation. It is therefore concluded that no extra cost should be incurred on account of trucks by reducing grades on long stretches of mountain roads because it would be physically impossible to reduce the gradients to maximums suitable for trucks.

For the safety and protection of all vehicles at intersections, it is necessary that the radii of turning lanes be great enough to accommodate trucks. On divided highways and at grade separations, increased facilities are necessary to permit longer vehicles to turn easily and safely. The proportional outlay involved in these added facilities is undetermined.

If only passenger cars were to be considered, it would be possible to design bridges using H-5 standards. Since bridges must accommodate all types of vehicles using the highways, H20-S16 is the standard of bridge design required to carry present legal load limits in California.

The Report on Public Aids to Domestic Transportation made by the Board of Investigation and Research in 1944 estimated that only about 14.5 percent of the total road costs assigned to motor vehicles collectively could be especially attributed to the differential requirements of vehicles of unusual weight or size.

Location of Roads

Location of roads and streets today is largely a matter of relocating existing inadequate facilities rather than creating entirely new routes. It is essential to make a complete study of the present and the future requirements of the area to be served in order that the investment may be wisely made, and, in the case of city routes, that a desirable pattern of community development may be followed.

Many factors, such as traffic patterns, types of vehicles, driver habits,

and origin and destination studies must be considered, and the design must be adequate for the amount and type of service to be rendered.

Many errors of location made in the past could have been avoided if engineers had been fortified with adequate traffic analysis data to define clearly the purpose of the facility to be constructed.

It is possible in many cases to improve the location of a road by taking full advantage of the terrain. This is particularly true in California, where many highways and streets are built in canyons or in rugged mountainous country. In widening a two-lane road to four lanes the new section need not necessarily follow the grade and alignment of the existing pavement. By separating the two parts of the road it may be possible to save on right-of-way costs, to provide for better landscaping along the route, and to increase safety by relieving the monotony of driving long distances on a straight, level road.

The acquisition of land on which to construct modern highways and streets constitutes a major element of cost, in contrast with earlier periods when property was not as highly developed and owners conceded much right-of-way to gain the benefits of new roads.

Rights-of-way for all systems must be adequate for future widening when required, to preserve the highway investment, to permit roadside development of scenic values including picnic spots and roadside parks along the route, and to control movement on and off the highway.

(*Continued on page 72*)

Corps of Engineers Shares Acclaim of Army's Many Brilliant Accomplishments

IN RECOGNITION of the great engineering work accomplished by the U.S. Army Corps of Engineers and in keeping with the spirit of Army Week—April 6 to 12—it is opportune to review the vital role played by the Army in shaping the destiny of this nation. Its great wartime accomplishments are well known to all, but its peacetime activities—though equally brilliant—are lesser known. Some of the highlights of the Army's early influences on the development of this country, and its more modern accomplishments and plans for the future—with particular emphasis on its engineering work—are briefed as follows:

The famous Lewis (Captain Meriwether) and Clarke (Captain William) expedition, opening the Northwest to American civilization, was an Army enterprise.

For the next half century, the Army was the only public organization able to encourage and assist the American pioneers. The Army conducted most of the preliminary explorations.

When frontiers were being relentlessly and recklessly rolled westward, the Corps of Engineers became a key unit in the development of the young nation's resources. Army Engineers built roads, widened river channels, dug canals, maintained the lighthouse service, and made topographic and geodetic surveys.

The first railroad in America was built by the Army!

Army engineers surveyed, constructed and even managed for a time many of the nation's earliest railroads including the Baltimore and Ohio, and the New York, New Haven and Hartford.

In 1853, Secretary of War Jefferson Davis dispatched five columns of Engineer troops to locate possible routes for a transcontinental railroad.

The participation of Engineer officers in the building of private railroads was in line with the policy of our national government to encourage such developments in every possible way. Without the loan of such trained engineers, building the Western railroads might well have been delayed another half century.

The Army stimulated the steel industry, guided it through its early development, and in cooperation with the Navy, gave impetus to its expansion.

EAST ACCESS ROAD to Garrison Dam site (to right of photo) on Missouri River (between trees and bluffs in background) is $1,163,000 preconstruction job under direction of District Engineer's Office, Fort Lincoln, Bismarck, N. Dak. Contract, awarded to S. J. Groves & Co. of Minneapolis, April 1946, is for necessary clearing, grubbing, earthwork and drainage structures for 13 miles of 8-in. portland cement concrete paving 24 ft wide. Work designated for 1947 includes bringing up elevation of pervious fill about 15 ft to meet bridge deck elevation on east bank—total of about 500,000 cu yd of fill. Grading during 1946 was completed with 18 D8 tractors and scrapers. Haul of pervious material was handled by eleven Super C Tournapulls and allied dozers and push "cats." Groves Co. operations are under supervision of P. F. Huntington, project manager, F. A. Vogelsberg, office manager, and Al Koalska, superintendent of excavation.

The science of interchangeable manufacture, revolutionizing industry, began in this country in 1798 with the filing of a contract for 10,000 muskets by the War Department.

In 1848, the Gold Rush was on. Thousands of emigrants surging westward, towns springing up overnight, settlers actually settling down, needed protection, demanded adequate transportation lines across the continent. It was the Army's projection of these transcontinental lines that led the way to the unification of the country.

When gold was later discovered in Alaska, the Army opened the harbors and built the roads and trails leading to the mines. Americans settling in this new country were protected from the lawlessness and mob rule by the Army.

The old Chesapeake and Ohio Canal saw a lot of travel in its day. The Erie Canal is still doing big business. Both were built by the Engineer Corps, which has worked on virtually every navigable body of water in the country.

The construction of the "Big Ditch" was probably one of the world's most difficult engineering problems. The French tried, but after years of struggle had to admit failure. In 1907, the Army Engineers, under Col. George W. Goethals, took over the job. Eight years later, after surmounting every conceivable obstacle from impenetrable jungle to dirt avalanche, the task was completed and the Canal opened for traffic.

Actually the French enterprise for building the Canal had failed because 75 percent of its workers died of Yellow Fever. Major Walter Reed and a group of Army medical officers determined that yellow fever is transmitted by the mosquito. Mosquito breeding spots were wiped out, freeing Panama of the dread scourge. (Havana had been ravaged by yellow fever for 150 years. Two months after Major Reed made his discovery, the city was cleared of the disease.)

The Army anticipated Mark Twain and did something about the weather. It organized the first weather bureau. Meteorological records compiled from the observation of Army surgeons (sic) from 1819 to 1860 laid the foundations for weather forecasting on a scientific basis. The work was then taken over by the Chief Signal Officer Albert J. Myer, also an Army surgeon.

BONNEVILLE DAM, ON COLUMBIA RIVER, exemplifies work of Army Engineers in developing this nation's resources. Program for regional development of land and water in Columbia River Basin aims at providing complete beneficial water control, to make possible, when and as required, irrigation of several million acres of land. Project can develop 15,000,000 or more kilowatts of hydroelectric power and can bring about uncalculated benefits through flood control, navigation improvement, control of pollution, expansion of recreation, and other potential water-use benefits.

The Corps of Engineers is carrying on a continuous series of studies with important applications for peacetime roadbuilding: Study of porous concrete, its use for drainage relief, and reduction of uplift under solid concrete paving; study of slope protection; study of water repellents, frost and moisture effects; design of most economical sections for reinforced concrete conduits; and research in soil mechanics.

The cone penetrometer was developed by Army Engineers. It consists of a metal cone and calibrated spring to register weight-supporting values of undisturbed soils in various terrains. (It may in time affect the future design of vehicles.)

The design of tactical bridging by the Engineer Corps may set the pattern for emergency highway bridging.

Continuing research is keeping airfield design abreast of the swiftly changing design of airplanes themselves.

Army Engineers have been the world's greatest airfield builders.

The Engineer Corps cooperates with neighboring communities of Army Posts in problems of water supply, sewage disposal, fire hazards, disease control, drainage. The Engineers have shown the way to many small communities in methods of malaria control and garbage disposal.

The Engineer Corps is responsible for construction of all Army hospitals. (Construction of Veterans Hospitals has now been assigned to the Corps of Engineers.)

Some of the Jobs Ahead

Missouri Basin Project, Ohio, Arkansas, Roanoke, Savannah, White, Red, Sacramento–San Joaquin, Willamette Basin Project, Merrimack, Housatonic, Thames, Susquehanna, Los Angeles, San Gabriel, Connecticut, Red River of the North Basin Project, Mississippi Development for Flood Control and Navigation—these projects will be completed with the same skillful "know-how" that has always characterized the work of the Army Engineers in enlarging America's resources.

The Army Map Service, Corps of Engineers, which during the war produced a stack of maps 300 times as high as the Washington Monument, is launching a huge peacetime program. The military mapping program will be designed to provide essential information and knowledge of the topography of the world.

Parties to a Construction Contract Make Their Own Law

OREN C. HERWITZ
Counsellor at Law, New York, N.Y.

NO MATTER HOW MAGNIFICENT may be the sweep of a bridge or how beautiful the design of a skyscraper, both owner and contractor must concern themselves with the cost to the one and the profit to the other. Here, even the lowly semicolon may be destined to play an important role, because it is the apparent meaning of a written contract, as indicated by the words and punctuation used, that may ultimately determine those all-important questions. It is impossible here to give a detailed account of all the legal problems and potential pitfalls involved in engineering and construction contracts. But attention is called to several basic principles which, like a foundation, underpin the whole towering edifice of contract law. An awareness of these will enable the engineer better to anticipate and avoid, as far as possible, the legal difficulties which almost inevitably follow a meeting of the ambiguous with the unexpected. For these inciters to dispute are, in the last analysis, the most prolific parents of misunderstanding and litigation between the parties to a contract.

AT THE OUTSET it is imperative to understand the true nature of a contract, for its real significance is the keystone upon which the law of contracts rests. Most people assume that a written contract is the piece of paper which the parties have signed, but actually the paper is merely evidence that a contract has been made. Its only function is to prove with certainty exactly what the terms of the contract are. In effect, the paper merely evidences an exchange of promises, but, to paraphrase an advertising slogan, something more must be added before an exchange of promises becomes a contract. And that something is the power or right to enforce the promise in a court of law.

We all know examples of legally unenforceable contracts, as for instance those of infants or insane persons. Therefore it follows that the most practical definition of a true contract is this:

"A promise or a set of promises for the breach of which the law gives a remedy, or the performance of which the law in some way recognizes as a duty."

Actually a true contract is like a statute because it, too, creates rights and obligations enforceable in a court of law. Contracts are merely little statutes, affecting however only the parties to them.

How a Court Decides Contract Disputes

To begin with, the court does not base its decision on any abstract principles of morals or ethics such as prevail in the law of personal injuries, where the obligation to pay damages is imposed on the defendant because it is morally wrong to injure another. No, the law of contracts is founded on the basic premise that the morals and ethics of the case, and consequently the law of the case, have been established for the court by the parties themselves. Thus it is that the court's main function is limited to: (1) Determining the nature and extent of the obligations the parties voluntarily created for themselves in their contract, and (2) enforcing these obligations to the full.

In the process of ascertaining the extent of the contractual obligation, the court does not normally concern itself with the intentions the parties *actually* had in mind when they wrote their contract. On the contrary, courts must look for what are termed their "apparent intentions," or the intentions disclosed by the meaning of the words used to express their agreement. Thus the test of intention is objective rather than subjective. This must be the rule because the parties are presumed to have put their agreement in writing for the purpose of indicating the exact nature and extent of their contractual intentions and of eliminating the possibility that anything not so indicated is or can be a part of their agreement.

But let the courts speak for themselves. The following are excerpts from judicial opinions pertinent to this subject:

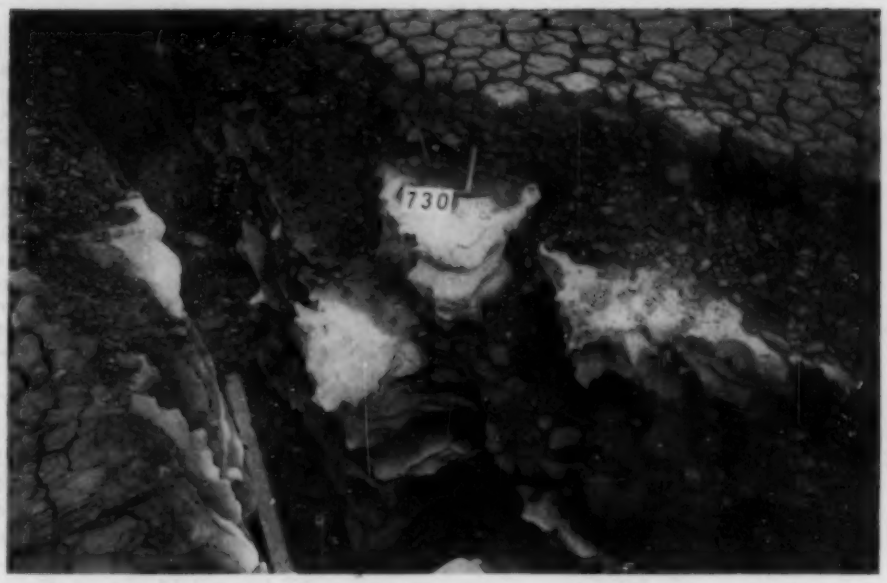
1. "Parties have a right to make agreements to suit themselves, and it is the duty of the court to enforce them as made, even though a hardship may be worked."

SUBSURFACE CONSTRUCTION conditions furnish most frequent source of dispute and litigation between parties to contract. Shown here is excavation for subcellar of Criminal Courts Building, New York, N.Y.

2. "Courts should not give to the agreement of parties . . . a meaning which it would prefer or which it may think the parties intended. Intention is to be found in the language used. It is the only sure guide."

3. "The intention of the parties is to be deduced from the language employed by them, and the terms of the contract, when not ambiguous, are conclusive, . . . *the question being, not what intentions existed in the minds of the parties, but what intention is expressed by the language used.*"

4. "Contracts are to be read and understood according to the natural and obvious import of the language,. . . Courts cannot correct suspected errors, omissions or defects, or by construction vary the contract of parties. If the words employed convey a definite meaning, and there is no contradiction or ambiguity in the different parts of the instrument, *then the apparent meaning of the instrument must be regarded as the one intended.*"



CONDITIONS AFFECTING FOUNDATIONS of structures are usually only ones that cannot be determined definitely in advance of construction. View is closeup of sinkhole in Tennessee River at site of Fort Loudoun Dam.

"Apparent Intention" Is Enforced

And so it is that courts generally enforce the apparent intention, as expressed by the meaning of the words used in the contract, even if this may not be *exactly* the intention the parties *actually* had in mind. Since punctuation as well as words is a device for expressing intention, is it any wonder that even the lowly semicolon may have expensive significance in court?

This search for apparent intention is, of course, made more difficult for the court if ambiguity in the wording or contradiction in the different parts of the instrument exist. In this situation an opportunity is presented for judicial interpretation. The result is that the court has more flexibility in deciding a case because the language of the contract, not being crystal clear, does not irresistibly compel a decision one way or another.

In reaching a decision, courts follow certain rules of contract interpretation to determine apparent intention. A few of these rules will be quoted. Others will be referred to in the discussion of the particular problems to which they apply.

One which has particular significance in construction contracts is this: "In case of conflict or ambiguity in the agreement, it is to be construed most strongly against the party who drew it, and any promise is to be construed in the way that the promisee had good reason to understand it."

Another is: "The courts always avoid, if possible, any construction of a contract that is unreasonable or inequitable, and especially one that will place one of the parties at the mercy of the other."

Still another rule is: "When the parties to a contract of doubtful meaning, guided by self-interest, enforce it for a long time by a consistent and uniform course of conduct (between themselves) so as to give it a practical meaning, the courts will treat it as having that meaning even if as an original proposition they might have given it a different one."

So much for some of the basic principles of the law of contracts generally. It is now proposed to examine some of the situations which most frequently cause difficulties and disputes in construction contracts in order to show how, in the light of the foregoing, the possibility of such disputes and consequent litigation may be minimized.

Subsurface Conditions Cause Disputes

Probably the most frequent source of dispute and litigation between the parties to a contract lurks in contracts involving subsurface construction. Here the opportunity for the "ambiguous" to meet the "unexpected" is magnified to the *n*th degree. As an ASCE committee has rightly said (in ASCE Manual 8, "Engineering and Contracting Procedure for Foundations"): "The conditions affecting the foundations of a structure are usually the only ones that cannot be determined definitely in advance of construction."

Improved techniques for preliminary underground exploration have enabled the engineer to make an educated guess about subsoil conditions. But even an educated guess is a risky business, for nature often shows a whimsical unconcern for man's data. In this situation fair dealing would seem to demand in the contract a clear-cut decision as to whether the owner or the contractor shall bear the risk of the unexpected.

In Manual 8 referred to above, it is recommended that the owner assume this risk. Among other things it points out that, "As the contractor is not usually consulted on the design, he should not be held responsible for results due to unforseen underground conditions not indicated on the plans and in the specifications."

Though the soundness of the committee's conclusion is amply supported by the principles of natural justice, yet, regrettably, it is to be noted that in lump-sum contracts the general tendency has been to shift this risk to the contractor. Most often the attempt is made by including in the contract generally worded clauses designed to protect the owner against additional liability should actual conditions prove to be different from those suggested by the preliminary subsurface data.

Unpredictable Risks Boost Bids

Aside from all other considerations, there are not only practical but also legal reasons why these generally worded clauses are unwise. Permit me to quote again from Manual 8: "General clauses charging the contractor with the entire responsibility for unforeseen costs, besides being unfair, may also, unnecessarily, result in higher total cost to the owner,

since the contractors may be expected to allow for these risks in their original bids and the owner will pay no matter whether or not they occur."

Correct though this observation is for the sound ethical and practical reasons stated, contracts continue to cling to the catch-all protective clause. One can only ascribe its persistent use to the belief that it generally accomplishes its intended objective, a belief that finds little support in the decisions of the courts to which it has been submitted for interpretation.

Actually, such generally worded clauses have had but a spotty record of success in the courts. Intrinsically inequitable, their attempt at a broad coverage must needs result, in most cases, in the use of ambiguous language. Thus they give the courts an opportunity to construe them strictly against the owner, who generally drafts them, in accordance with the rule of interpretation to which reference has already been made. The result may be that the owner will pay the added contingency item in the bid in any event, and in addition, if the unexpected has occurred and the so-called protective clause doesn't protect, may have to pay the added costs to the contractor.

Space does not permit an examination in detail of the many decisions on this subject to determine when and under what conditions the generally worded clauses fail to protect. The cases are difficult to reconcile and therefore it is not usually possible to predict with accuracy whether owner or contractor will ultimately be held to have assumed the risk of the "unexpected." The major lesson to be learned from a study of the cases, however, may be boiled down to this simple proposition: The use of anything but the very clearest and frankest language is an invitation to litigation, with results that may be an expensive disappointment to the owner.

Unmistakable Language Required

If, despite all the good reasons against it, the owner desires to require the contractor to assume the risk of unexpected subsoil conditions, then the contract should say so in unmistakable terms. Best would be a statement in clear, simple English that the contractor is assuming the risk that subsurface conditions may turn out to be different from what he may have reason to expect from the preliminary subsoil information made available to him by the owner, and that he will accomplish the desired result for the bid price, despite any variance between assumed and actual conditions.

THE AUTHOR

No stranger to engineers is Oren C. Herwitz. Not only has he worked closely with them for years as a practicing lawyer in New York City, but also his work as Deputy Commissioner and Special Counsel to the Department of Public Works of the City of New York, which position he held from 1940 to 1946, with a three-year tour of duty as a major, Corps of Engineers, in World War II, likewise brought him into close touch with matters engineering. As an author he has appeared in ASCE's TRANSACTIONS ("The Risk of the Unexpected in Subsurface Construction Contracts," Vol. 105, 1940, page 454).

One final word of caution if such a clause is used. It is a rule of contract law that "a man cannot contract against his own fraud." This basic principle requires that the owner be scrupulously careful to give the contractor every available scrap of information which in any way may be relevant to subsoil conditions. Otherwise the protective effect of the clause might be lost. Justice does not permit a man to induce another to take a contract by concealing material information and then to protect himself in the contract itself against responsibility for such concealment. Not even the most clearly worded protective clause will do the trick. This is as basic in the law as the restriction against enforcing promises which call for the performance of illegal acts. And in this type of case even an honest and wholly unintentional withholding of what later may prove to have been material information is included in the category of legal "fraud."

It is to be hoped, therefore, that owners and their engineers will avoid this danger and, in view of the unpredictable effectiveness of the so-called protective clauses on the legal battlefield, will frankly and unequivocally assume the risks in subsurface contracts that justly should be theirs.

Delays

Another of the principal risks in construction contracts, with costly possibilities to the contractor, arises from delay in completion. When these delays result from the acts or omissions of the contractor himself a legal problem is rarely presented, since there is no inherent injustice in making him assume in the contract the consequences of his own or his subcontractor's mismanagement.

If, however, the delay is caused by acts or omissions of the owner, a legal problem may be presented, for many contracts contain provisions designed to make the contractor assume the added cost of such delays. Such provisions generally allow the contractor merely an extension of time for the delay, which results only in the avoidance of an assessment of liquidated damages and not an avoidance of extra costs engendered by the delay. Some contracts go so far as to prohibit the contractor from even claiming the additional expense caused by the owner's delay—a prohibition which, regrettably, exists in many of the contracts prepared by the City of New York.

Such clauses are in direct conflict with the basic principle of contract law which holds that "it is the duty of one party for whom another is doing work under a contract, to do his or its part to facilitate the work." Such clauses also call into operation the principle of contract law that "words which are intended to exempt a party from liability because of its own fault are to be construed strictly against it." It is therefore not surprising that when such clauses become the subject of litigation, their record of effectiveness is somewhat tarnished.

"Protective" Clause May Not Protect

Thus it has come about that, despite these clauses, owners have sometimes been held liable for the extra cost to contractors, especially when the court considered the owner-caused delays to be of such unreasonable duration as to approximate an abandonment of the contract. Similar decisions have been reached where the cause of delay was the owner's failure to live up to an express contract obligation, as, for instance, the failure to furnish additional details or to approve shop drawings within the time specified in the contract.

As a result it is safe to say that such protective clauses, like others we have considered, may give only apparent and not real protection. For this reason they should not be permitted to engender in the owner and his engineer any but the most tentative sense of security, lest it cause them to create the very situation which may destroy whatever effectiveness the clause might have had.

Legal problems involved in extra-work claims, the specification of means and methods of construction, and the protection of the legal rights of the parties to a contract litigation, will be dealt with by Mr. Herwitz in an article to appear in the May issue of CIVIL ENGINEERING.

These articles are based on a paper read before a recent meeting of the Metropolitan Section of ASCE.

EXPERTS DISCUSS

Airport Construction, Operation and Maintenance

AT ARBA TOWN MEETING

FOLLOWING ARE EXCERPTS from the "Town Hall Meeting on Airports," an interesting and informative session of the 44th Annual Convention of the American Road Builders' Association. Presiding over the meeting was Harold F. Clemmer, M. ASCE, chairman. The role of moderator for the 37-man panel was taken by Col. Floyd Evans, director, Michigan Department of Aeronautics.

QUESTION: What are the principal elements of an airport layout?

ANSWER by Hyman Shifrin, M. ASCE, Horner & Shifrin, consulting engineers, St. Louis, Mo.:

IRRESPECTIVE OF THE class or size of an airport, the first consideration must involve a study of the type of aircraft and volume of plane movements, in order to determine the class of airport necessary.

The second step involves a site study for runway layouts, taxiways and terminal area, with an integration of these three items for an efficient operating layout. The term "terminal area" covers not only the terminal building, but the loading platform or apron for passenger and cargo planes, the access roads to serve the terminal building, and the apron and parking areas for service vehicles. It also includes housing or hangars for planes in and near the terminal building, and hangars and shops for services, which in major airports should be some distance from the principal terminal area.

* * * *

QUESTION: What types of airports require super-compaction of subgrades and base courses, and why is this desirable from the point of view of airport operation?

ANSWER by O. J. Porter, M. ASCE, O. J. Porter & Co., consulting engineers, Sacramento, Calif.

ALL AIRPORTS designed for use by the heavier aircraft of today, and especially those of tomorrow, need super-compaction of upper base courses, also of the subgrade where the natural material is sufficiently strong to allow a base and pavement thickness of less than 4 or 5 ft. Airports constructed for use by lighter airplanes, such as DC-4's, need super-compaction for lesser depths—say 2 or 3 ft below the top of the pavement.

Plans for all major international air terminals, such as those at New York, Baltimore, San Francisco, Buenos Aires, those in Canada, Australia, Union of South Africa and Europe should definitely provide for super-compaction of all materials for a depth of at least 5 ft below the top of the pavement.

* * * *

QUESTION: What economies can be effected by "super-compaction"?

ANSWER by Henderson E. McGee, Assoc. M. ASCE, Engineer, Sacramento District, Corps of Engineers.

SOIL TECHNOLOGY has established that the supporting value of soils increases with densification. Therein lies the real value of super-compaction in that more effective work is obtainable from more highly densified soils if they are capable of accepting super-compaction. In other words, when super-compacted soils are provided for a client, he gets more value per unit cost. An example will illustrate this.

Assume a flexible pavement section for a 150,000-lb wheel load that is to be placed on a 5 percent CBR subgrade which can be increased to 10 percent CBR when compacted to 95 percent of the maximum density obtainable. Corps of Engineers design criteria stipulate that the 18-in. zone between 37 in. and 55 in. below the pavement surface have a bearing value of not less than 10 percent CBR. If this zone could be compacted in place, construction costs would be reduced below those involved in excavating this 18-in. thickness of material, stockpiling, and reprocessing it back on the grade. Situations similar to the example cited pertained for the extension of the runway systems at Mather Field and Fairfield-Suisun. The compaction-in-place requirements of the specifications were accomplished satisfactorily where the soil types were susceptible of such treatment.

* * * *

QUESTION: Is the California Bearing Ratio (CBR) method of design still the best practical means of evaluating subgrade support for flexible pavements?

ANSWER by T. A. Middlebrooks, Assoc. M. ASCE, Chief, Soil Mechanics Section, U.S. War Department, Washington, D.C.

YES, THE CBR METHOD is still definitely the best practical and proved means of evaluating subgrade support for flexible pavements. Al-

GRADING OF SLOPING FILL on edge of runway area for Seattle–Tacoma Airport precedes bringing in of top soil for landscaping.

CONSTRUCTION PROCEEDS on enlargement of San Francisco's Mills Field airport.

though it is not perfect, it has fewer variables, less uncertainties, and a more general application than any other known method. The plate bearing test was thoroughly investigated by the Corps of Engineers before adoption of the CBR method, and these investigations are continuing. Most of the major questions concerning the plate bearing test method are still unanswered, such as: (1) What is the allowable deflection which varies with type of base, depth of base, tire pressure, contact areas, etc.; (2) what part of the measure deflection is due to consolidation, to shear deformation or to elastic deformation; and (3) how can correction for moisture variations be reliably made.

* * * *

QUESTION: What is the major soil characteristic that influences subgrade support?

ANSWER by Mr. Middlebrooks:

THE SHEARING STRENGTH of the soil at a low percentage of strain is *the* controlling factor in determination of subgrade support. The shearing stress in the subgrade must be sufficiently low to prevent progressive deformation of the soil under repeated load applications. Elastic deformation is not a factor where the asphaltic concrete surface is of conventional design. Deformation due to consolidation or compaction of the soil under repeated loads is not a factor in evaluation of subgrade support provided the shearing strength is determined for the density in question. This deformation and resulting unequal settlement are major factors from the maintenance standpoint. It must be concluded therefore that a test, to be satisfactory for evaluation of subgrade support, must be principally a shear test with the consolidation influence eliminated or reduced to a minimum.

QUESTION: What methods are being employed to speed settlement of the muck-filled airport sites at LaGuardia Field?

ANSWER by Commodore Frederick Reinicke, Commissioner of Marine and Aviation, New York, N.Y.

LAGUARDIA FIELD, formerly North Beach Airport of 105 acres, was enlarged to the north and east to its present acreage of 550 by the truck-dumping of about 12 million cu yd of cinder ash and miscellaneous-products fill from Rikers Island between 1937 and early 1939. The fill was placed over an average depth of 26 ft overlying a soft organic silt of an average depth of 60 ft, beneath which is sand soil. The average runway elevation was 13.5 ft above mean low water; at present it averages 9 ft over the settled areas and settlement is continuing. If nothing is done it will take about 50 years before a natural stable condition is reached.

The silt stratum under the fill contains a high percentage of water, which is being slowly squeezed out by the weight of the fill overburden. The problem lies in the elimination of the slow and differential settlement. All known methods were closely investigated by the consultant engineers for the department, and the method of filter wells recommended suits the particular conditions at LaGuardia Field.

The installation of vertical sand-drains and placing of a fill overburden will accelerate the process of nature in an estimated two-year period and will consolidate the silt stratum by squeezing out the void water into the sand drains, with access to a horizontal filter blanket and thence to free groundwater.

(It is, of course, impossible to give the highlights of the engineering phases of this problem in such short form.) The subsoil investigation and recommended stabilization of the airfield were the subject of a comprehensive engineering report by Capt. E. Praeger, M. ASCE, of the firm of Madigan-Hyland, consultant engineers on the project.

* * * *

QUESTION: Are combined drainage systems, those designed to remove both surface and subsurface water in one line, practical? If so, why?

ANSWER by William Slee, Airport Engineer, Robinson Clay Products Co., Akron, Ohio.

YES, WHEN PROPERLY DESIGNED and installed, these combined systems have a very practical application in airport construction. First, if one line of pipe can perform the functions of both a surface drain and an underdrain, the economic aspect of such a design is clearly apparent. Two types of combined systems have been successfully used. In one type the pipeline is installed at the edge of the runway, taxiway or apron, and a properly designed porous backfill is brought up to the elevation of the finished grade. In the other type, the runway or paved surface is designed with gutters inside the edges of the paved section. In this case the pipeline is installed directly under the flow line of the gutter, and the surface water enters the line through grate-top catch basins.

I believe that the best types of pipe to use for an installation of this kind are either semiperforated pipe with sealed joints, or cradle invert pipe, commonly called skip pipe. One advantage of the combined system is that it intercepts the surface water at the edge of the paved surface and eliminates the danger of destructive wash and erosion over newly seeded shoulders. Another advantage in the removal of surface water at the edges of the pavement is that it does not have the chance to work in under the edge of the pavement, soften the subgrade, and establish a definite point or area of pavement failure when heavy wheel loads are imposed.

One example of the first condition is the Suffolk, Va., airport. A fine ex-

DIESEL TRACTOR AND DRAGLINE clear out mud pocket at Idlewild Airport, New York, preparatory to filling with sand for construction of asphalt paved landing strip.

ample of the second condition is the Washington National Airport, where the marginal drains were installed some years after the field was in operation.

* * * *

QUESTION: What do you consider to be the most important features in the design and construction of an airport drainage system?

ANSWER by Mr. Slee:

1. THE PROPER DESIGN of the porous backfill in either independent underdrains or in combined systems.
2. The employment of competent, experienced drainage engineers.
3. The utilization of high-type, thoroughly experienced field engineers and inspectors during the period of construction.

* * * *

QUESTION: How are specifications for granular material developed?

ANSWER by Col. William H. Mills, M. ASCE, Civil Aeronautics Administration, Atlanta, Ga.:

THE CLASSIC EXAMPLE of the development of such a specification was the pioneer work of Dr. C. M. Strahan, M. ASCE, more than 20 years ago. He visited 50 or more counties in the State of Georgia observing dirt roads and sampling materials "where firmness and water-resisting qualities were noted in contrast with ordinary conditions." Data from laboratory tests on these samples were coordinated with road behavior under varying conditions of weather and traffic, and the conclusions formed the basis for the selection of good material. The gradation curves developed in this study are still used for judging the suitability of sand clays and top soils.

Until a satisfactory stability test is developed, specifications for granular materials must be based on experience in using the material in actual service. In the beginning of the development of the use of a material, specifications often contain requirements which are very restrictive and often merely identify the source. As the background of experience is enlarged and strengthened, specifications based on the service behavior of the material can be prepared. This type of specification usually results in a decrease in the cost of the material because of an increase in the sources of supply.

SIDE BOOM LOWERS junction box for runway traffic lights at Idlewild Airport, New York, N.Y.

* * * *

QUESTION: How deep should storm drains and subdrains be placed?

ANSWER by J. M. Robertson, Jun. ASCE, Drainage Engineer, Armco Drainage & Metal Products, Inc., Middletown, Ohio:

THIS QUESTION REQUIRES a separate answer for storm drains and for subdrains. Economics of the problem dictate that storm drains be placed as shallow as possible to save excavation and to meet some given outfall elevation. The only deviation from this principle is to increase the depth of cover to secure proper slope, keep below frost level, and/or decrease load on the pipe from concentrated surface loads.

Engineers are prone to forget the difference between farm drainage and construction subdrainage. In farm drainage a reduction in available moisture at the surface is desired, while in construction work the aim is to completely eliminate free water from the surface and usually to some distance below. Too many subdrains in the past have been installed with no thought given to this fundamental difference.

The required depth for subdrainage lines varies with conditions on the site. Before installation, subsoil investigations are necessary to determine free-water-table elevations, water-bearing strata, and soil permeability. This information will indicate the location and depth at which the lines must be placed to give the desired results.

In many cases the depth of subdrains will be such that they can empty into the storm sewer system. In other cases, to obtain good performance, the lines must be installed below the elevation of any available outlets. This is not particularly objectionable since the quantities of water involved are usually small and the benefits derived by pumping the flow more than overcome the expense involved.

* * * *

QUESTION: What arrangement of expansion and contraction joints is recommended for concrete airport pavements?

ANSWER by A. A. Anderson, Assoc. M. ASCE, Manager, Highways and Municipal Bureau, Portland Cement Association, Chicago, Ill.:

THE TREND IN DESIGN of concrete pavements, whether for airports or roadways, is toward the use of fewer expansion joints or none at all. This is a logical development based both on theoretical calculations of stresses and on observations of pavements in service.

When concrete is placed there is an initial shrinkage which occurs at about the same time the concrete hardens. Later, as the concrete dries, it is further shortened. If the space provided by these actions is kept available for expansion, subsequent rises in temperature will not cause critical compressive stresses to develop in the pavement. It is now believed the blow-ups have resulted from failure to preserve the space left by shortening of the slab. Infiltration of dirt, sand, etc., into joints and cracks made this space unavailable for subsequent expansion, causing high compressive stresses which resulted in blow-ups.

To prevent blow-ups, we must prevent infiltration. It is almost impossible to seal cracks effectively against infiltration, as material applied to the surface of the pavement for the sealing of cracks is easily removed by traffic. It is relatively easy to maintain an effective seal at a properly constructed dummy-groove contraction joint. If contraction joints are used at intervals which will control intermediate cracking, the joints may be sealed and not enough cracks will form to allow infiltration to become a serious problem. With infiltration under control, expansion joints may be omitted.

The only expansion joints needed are at intersections of runways, taxiways and aprons, or where the pavement abuts on a hangar or other building. Local experience is the best

BULLDOZERS PUSH SAND into swamp on construction of Idlewild Airport, New York, which when completed will be one of the country's most modern airports.

guide to the exact spacing of contraction joints that will control cracking. Usually about 20 ft will be satisfactory if the coarse aggregate in the concrete is crushed stone, 15 ft if it is slag or gravel.

Pavement so jointed will have minimum first cost and maximum structural capacity.

* * * *

QUESTION: Should concrete pavements be made of air-entrained concrete?

ANSWER by Mr. Anderson:

THAT DEPENDS UPON where the airport is located. If it is in an area where there is considerable freezing and thawing, where ice and snow accumulate, and where concrete pavements are subject to scaling, the answer is a decisive "yes"!

Air-entrained concrete costs no more than other concrete. It involves no special construction problems. In fact, its improved plasticity and workability make it somewhat easier to place and finish, and its freedom from bleeding permits it to be finished almost as soon as placed, so that at the end of the day the finishers may go home with the rest of the crew, avoiding costly overtime payments.

* * * *

QUESTION: What are the advantages of tar as a prime-coat material for subgrade and base courses?

ANSWER by Burton J. Bell, Chief, Technical Information Branch, South Atlantic Division, Chief of Engineers, Atlanta, Ga.:

THE LIGHT GRADES of the commercial grades of tar produced for paving purposes have definite advantages for priming non-bituminous base courses. These grades of tar penetrate to a greater depth than other bituminous materials, thoroughly binding the materials on the surface of the base course and rendering the base course comparatively waterproof. The closely bound surface of a non-bituminous base is highly desirable to protect the base course from the weather until the bituminous pavements are placed and to resist possible damage from the placing of equipment during paving operations.

* * * *

QUESTION: Are tar mixtures satisfactory for the service portions of airport aprons?

ANSWER by Mr. Bell:

TAR IS ONLY SLIGHTLY SOLUBLE in gasoline, lubricating oil, and other types of petroleum products used for servicing airplanes. For this reason, dense-graded hot-mix tar pavements do not readily absorb drippings of petroleum products. Further, the presence of the petroleum products on tar pavements does not destroy the binding power of the tar and hence has little effect on the serviceability. Our experience in the Southeastern States has indicated to date that satisfactory service aprons may be built with dense-graded, hot-tar, plant-mixed paving mixtures.

* * * *

QUESTION: Are all types of asphalt pavements suitable for airports?

ANSWER by George Dent, District Engineer, The Asphalt Institute, Washington, D.C.:

YES, ANY OF the four general types of asphalt pavements may be used on airports. They are: surface treatment, mixed-in-place, penetration macadam, and plant-mix. The Asphalt Institute recommends plant-mix and penetration macadam for use on heavy-duty airports of the magnitude of Washington National Airport and LaGuardia Field. The lighter types of surfacing, that is the surface treatments and road mixes, are better employed on the Class 1, 2 and 3 airports. All four types of pavement will give satisfactory service and there are many airports already in existence that are paved with the several types of paving mentioned. There are a number of combinations of flexible base and surface that may be worked out on an engineering basis to take advantage of the versatility of asphalt pavements.

* * * *

QUESTION: Is it possible to increase the bearing capacity of a flexible pavement after it is once built?

ANSWER by Mr. Dent:

YES, IT IS QUITE EASY to do so. As a matter of fact, engineers recognize this property in flexible pavements when constructing airfields that may possibly grow in size. For instance, it is entirely possible and practicable to construct a low-cost road-mix pavement on a suitable base for, say, wheel loads of 15,000 lb. If it is desired to increase the load-bearing capacity to 70,000 lb, it is only necessary to build a second flexible pavement of plant-mix type on top of the already existing mixed-in-place pavement.

It may be necessary in some cases, if the increase in wheel loads is extremely great, to sandwich in between the asphalt pavement surfaces a layer of non-asphaltic material, such as waterbound macadam or a graded gravel base course. By use of this procedure, the runway is strengthened by the sandwich course and the cost is kept down at the same time.

All photographs used in this story are by courtesy of the Caterpillar Tractor Co.

NEW JERSEY HIGHWAY MODERNIZED

MODERNIZATION OF WORLD'S heaviest traveled highway—a 3-mile section of Newark–Elizabeth, N.J., link of Route 25—includes construction of steel "sign bridges" over roadway. Longest span of five such structures is 80 ft. Others vary in accordance with width of roadway and importance of road junction. Three-mile section of highway is being widened from four to eight lanes divided into four 32-ft roadways—two for opposing through or express traffic, flanked by two for local travel. Investment of $3,000,000 for safety and continuous traffic flow at legal speeds is involved.

Modern European Practice Promotes Economic Use of Timber Structures

E. GEORGE STERN, ASSOC. M. ASCE

Head, Department of Wood Construction, and Director, Wood Research Laboratory, Virginia Polytechnic Institute, Blacksburg, Va.

ADVANTAGES OF cheapness, availability and adaptability have increased the popularity of timber as a structural material during the last ten years. Larger spans and new designs have been successfully attempted and careful tests have produced a variety of useful data never before available to the designer in this material. In this article highlights are presented of recent progress in Europe on timber investigations and structures, with particular emphasis on developments in Switzerland.

REFERENCES IN TEXT (such as "beams[1]") are to bibliography on page 39. Additional and more detailed information on this subject is given in the following: Virginia Polytechnic Institute Engineering Extension Division Bulletin No. 45 (November 1946), "Modern Timber Construction in Europe," by E. George Stern; "Tests on Wood Joints with Metal Connectors," by E. George Stern, CIVIL ENGINEERING, May 1941, page 298; "Timber Research and Timber Structures," by Ira D. S. Kelly, Assoc. M. ASCE, CIVIL ENGINEERING, December 1939, page 727; "Plywood and Laminated Timber Construction," by Ira D. S. Kelly, CIVIL ENGINEERING, January 1940, page 25.

A SHORTAGE OF STEEL for structural purposes during the war spurred timber construction to great advances. The numerous improvements have resulted from both experimental work in testing laboratories and new experience in design and construction.

The publication in 1942 of the revised "SIA-Standard No. 111" had as great a significance for the Swiss timber engineer as the 1944 publication of the "National Design Specifications for Stress-Grade Lumber and Its Fastenings" had for his counterpart in America. The increase in permissible stresses specified in the new standards resulted not from a desire to make the same construction materials go further, but from new knowledge gained in numerous tests leading to a better understanding of wood as a structural material.

Theoretical and experimental investigations were performed on keyed compound timber beams,[4] which resulted in the construction of emergency bridges with such beams and in the presentation of an approximate method for the determination of the strength of compound beams with key or dowel connectors. The load-carrying capacity of a keyed beam depends on the stress distribution within the beam and on the stiffness and shear resistance of the assembly as influenced by the efficiency coefficient for the connectors between the individual sections of the beam. The stress distribution depends on the type of loading, on shape and moduli for both beam sections and dowels. However, before the approximate method for computing properties of compound beams can be generally applied, the resistance to deformation of the various types of keys and dowels must be determined experimentally, as is evidenced in Fig. 1.

Although built-up nailed wood plate girders consisting of top and bottom chords, columns, and two systems of crosswise diagonal boards had been previously built, computations and formulas for such girders were first published in 1943.[8] These nailed plate girders are to be considered trusses with the chords alone resisting the bending moments and the board diagonals replacing two sets of infinitely closely spaced crosswise diagonals. As the joints between chord members and diagonals are partly fixed and very close to each other, the distortion of the chord members is a continuous one in contrast to the distortion of chord members of open trusses.

If feasible, uniformly applied loads should be transmitted directly to the

FIG. 1. EXPERIMENTS DETERMINE INFLUENCE of efficiency coefficient of key or dowel on strength of keyed compound timber beam.

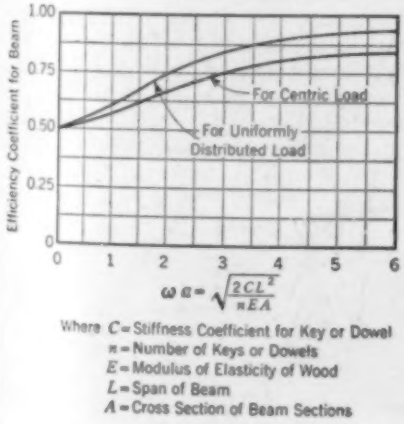
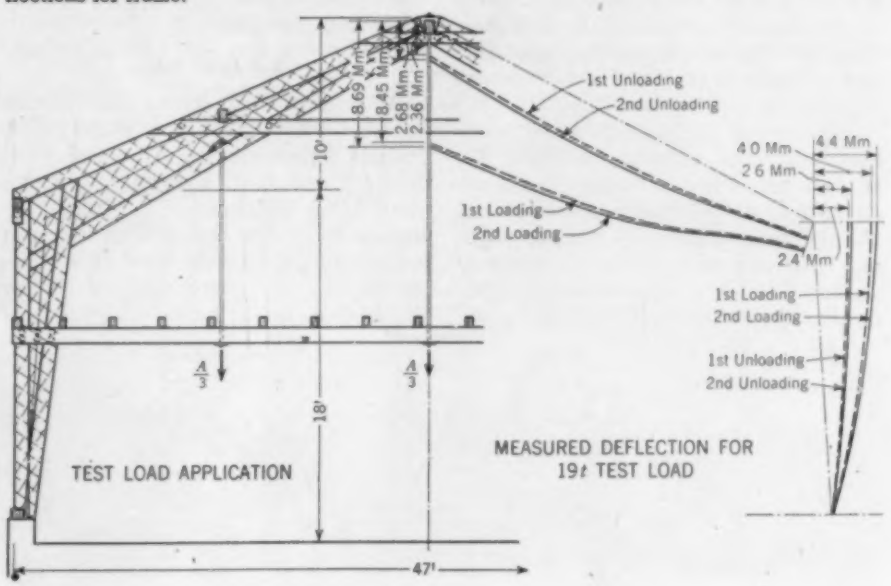

Efficiency Coefficient for Beam
1.00
0.75
0.50
0.25
0
0 1 2 3 4 5 6
For Centric Load
For Uniformly Distributed Load
$\omega = \sqrt{\frac{2CL^2}{nEA}}$
Where C = Stiffness Coefficient for Key or Dowel
n = Number of Keys or Dowels
E = Modulus of Elasticity of Wood
L = Span of Beam
A = Cross Section of Beam Sections

FIG. 2. DIAGRAM OF NAILED wood plate girder frame, with 47-ft span, shows test deflections for frame.



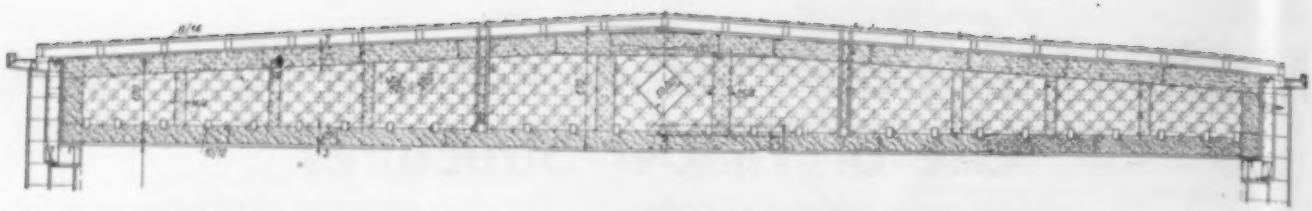


FIG. 4. CONSTRUCTION details for nailed wood plate girder in Fig. 3. Dimensions are in centimeters.

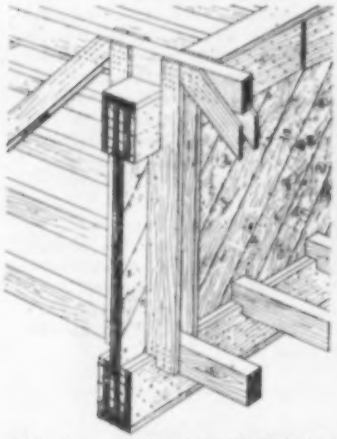


FIG. 3. NAILED CONSTRUCTION FORMS wood plate girder of 53-ft span shown in Fig. 4.

FIG. 5. NAILED TIMBER TRUSS of 38-ft. span is used in storage shed construction.

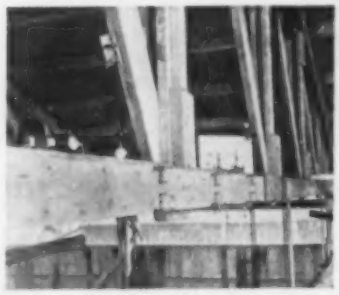


FIG. 6. NAILED TIMBER TRUSS of 80-ft span supports roof.

FIG. 7. PLATFORM SHELTER utilizes laminated T-shaped column for support.

diagonals, so as not to apply excessive secondary stresses to the nails connecting chord members and diagonals. Single loads may have to be transmitted to diagonals through chord members. This can be safely accomplished by the use and satisfactory arrangement of a sufficient number of nails. Any torque in eccentrically loaded chord members must be prevented by these nails and possibly by the supplementary installation of bolts to fasten chord members securely to diagonals.

Experience in nailed wood construction was greatly enriched by studies and tests performed on such structures in Solothurn, Switzerland, during 1938–1940.[6] A nailed plate-girder frame of a span of approximately 47 ft was tested (see Fig. 2). Nailed wood plate girders over a 53-ft span (Figs. 3, 4), nailed timber trusses over a 38-ft span (Fig. 5), and over an 80-ft span (Fig. 6), and other structures were also tested and these tests were supplemented by numerous minor laboratory investigations. Test loads and elastic and plastic deformations were observed, which permitted the investigators to advance the principal conclusions given in the following paragraphs.

Results of Tests

The computed stress distribution in the 3-hinged nailed plate-girder frames under investigation was verified by one test, but only approximated by another. The stress decrease from the inner to the outer boards of the chords amounted to as much as 10 percent. Secondary stresses in the relatively high girder were predominant. The computed moments of inertia for the full cross-section, exclusive of the web, were effective 94 to 100 percent. The tested low trusses with narrow fields had an efficiency similar to that of the plate girder. The trusses with eccentric connections had an efficiency of approximately 84 percent and those with concentric connections had an efficiency of approximately 100 percent. Secondary stresses due to fixity of the joints were largest in the secondary members and reached values of 53 percent.

Decrease of actual stresses as compared with design stresses was found to be a maximum in the diagonals, that is, as much as 60 percent, as a result of the continuity of chord members and the presence of secondary moments and stresses. The elastic deformation could be computed satisfactorily according to the effective moments of inertia given. Deformation due to motion in the joints amounted to 20 percent of the change

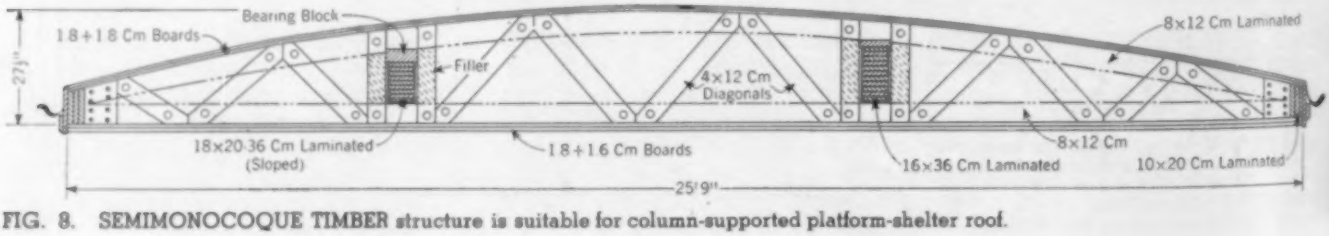


FIG. 8. SEMIMONOCOQUE TIMBER structure is suitable for column-supported platform-shelter roof.

in length of the individual members. The largest amount of plastic deformation took place during the first loading cycle and amounted to 31 percent for the nailed plate-girder frame, to 22 percent for the low truss with narrow fields, and to 32.5 percent for the high open truss with relatively slender members.

Whenever the nailed joints were designed for a safety factor of 3, the actual safety factor with respect to critical deformation was 2 to 2.5. The observed initial plastic deformation was a result of the local balancing of stress during initial local deformation around the individual nails. According to load-deformation curves obtained, the following equations could be advanced:

	Elastic Range	Plastic Range
Distortion of joint	$\tan \alpha = 0.056M$	$\tan \alpha = M^3$
Deformation of joint	$\Delta = 0.04P^2$	$\Delta = P^2$

if moment, M, is given in meter tons, deformation, Δ, in millimeters, and load, P, in tons.

The nailed wood constructions could be considered economic, adaptable, strong, and stiff—supporting, equally well, static and dynamic loads—and suitable for temporary as well as permanent structures. Because of the possible utilization of short members with small cross sections, nailed structures proved to have their own particular merits.

Glued Laminated Construction

Glued laminated construction for the posts and girders of some of the platform shelters of the Swiss railroads made use of the high permissible stresses for structures glued up with selected lumber. These wood structures proved to be 15 percent cheaper at the time of erection than corresponding designs for steel, and also showed other advantages. Fixed laminated $6^3/_8 \times 18$-in. posts, spaced 35 to 42 ft apart, support the 25-ft wide roofs by means of $6^3/_8 \times 17$-in. laminated cantilevered joists and $2^1/_2 \times 4^3/_8$-in. laminated rafters, spaced 2 ft $7^1/_2$ in. on centers and tapered in such a way as to give the roof the necessary pitch (Fig. 7). The joists were designed not to rest directly on the laminated columns, but are supported by two side members placed on the columns. The joists are connected to these side members by means of 6-in.-dia split rings. Such a design decreases the stresses perpendicular to the fibers of both joists and columns and decreases the free span of the joists.

The posts were laminated by bending and gluing boards into one-half of the T-shaped lower part of the column, gluing together these two parts, and gluing onto this assembly the horizontal straight boards of the upper part of the column. Tests showed wood-shear failure along one of the first inner continuous bent boards upon application of a total load of 45 tons, thus indicating a factor of safety of more than 4.0. Internal stresses due to bending of the boards were very large because of the small bending radius with a ratio of board thickness to radius of 1 to 125. Upon three-month conditioning, 80

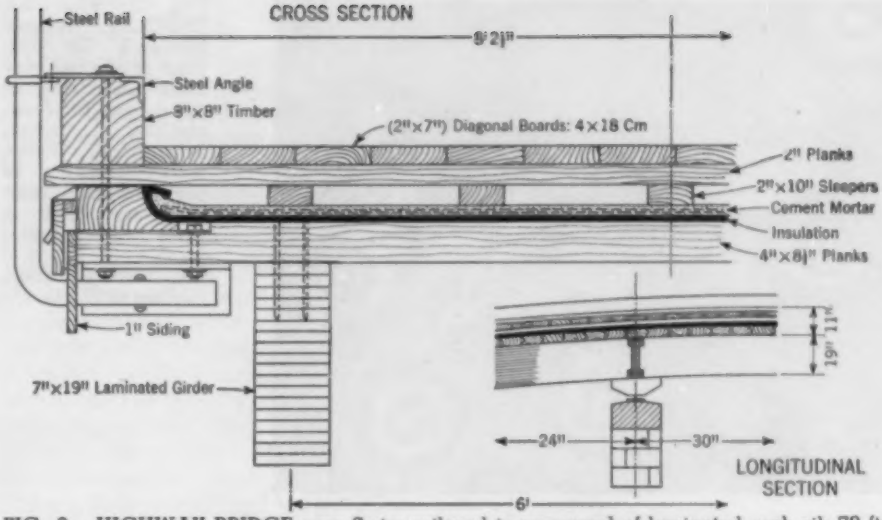


FIG. 9. HIGHWAY BRIDGE over Swiss railroad is composed of laminated arch rib 78 ft long (shown in cross section) on swivel supports (shown in longitudinal section).

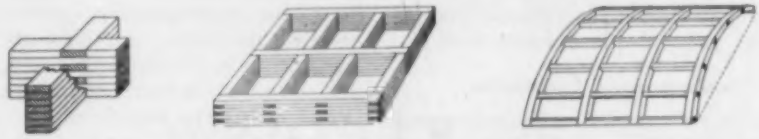


FIG. 10. GLUED-UP LAMELLA construction (diagrammatic detail, left) includes flat grid (center) and curved grid (right).

FIG. 11. FALSEWORK FOR HIGHWAY-RAILROAD BRIDGE of 590-ft span over Elorn River, France, is floated away after erection of concrete arch.

FIG. 12. FOLLOWING COLLAPSE of nearly completed 810-ft fixed wood-arch falsework for Sandoe Bridge, Sweden, trestle-supported falsework arch is placed for new structure.

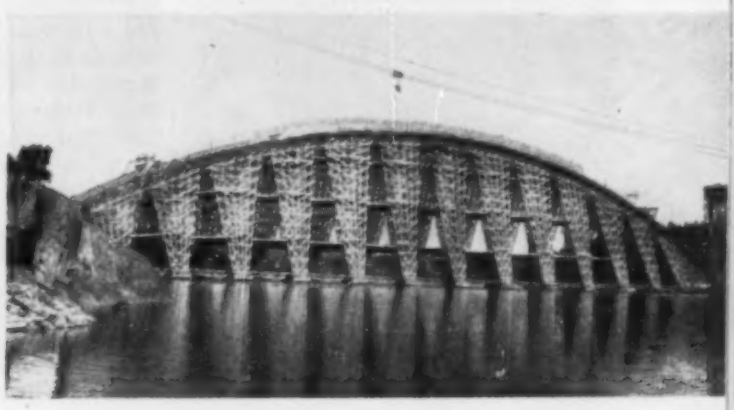


FIG. 13. FAN-LIKE TRESTLES support falsework for two fixed reinforced concrete arch ribs of 430-ft span for Fuerstenland Bridge, Switzerland. Falsework—consisting of prefabricated members assembled in place—shows settlement of only $1^1/_2$ in. at center although given camber of $2^1/_2$ in.

percent of the deformation due to bending proved to be elastic and 20 percent to be plastic deformation.

Semimonocoque Construction

Another Swiss platform-shelter roof follows the design of a semimonocoque construction with laminated longitudinal joists. It has a simple bottom chord, a bent laminated top chord, and connector-jointed diagonals for the main trusses, with top and bottom skins consisting of two crosswise layers of 1-in. boards nailed to the trusses and to the laminated longitudinal joists. The inner boards were sawn; the outer boards were planed and jointed with tongue and groove. This construction, comparable to an airplane wing construction, allows a fully closed-in roof design which provides for a relatively large resistance to both uplift and torsional stresses (Fig. 8).

Laminated Arches

Several laminated arch constructions were used for Swiss railroad crossings for secondary highways. These arches consist of 7×19-in. girders laminated with 18 boards. Laminated I-sections are used for cross-bracing of the arch ribs. They rest on supporting columns by means of ring-connected oak swivel panels. The entire bridge, excluding railings, is of wood construction, with the road surface built up of tongued and grooved planks 4 in. thick (Fig. 9).

Glued laminated construction was particularly emphasized in the construction of the buildings for the 1945 Swiss Trade Fair in Basel. Simple beams of glued-up boards over spans of 52 ft with a maximum cross-section of $7\times31^1/_2$ in., and supported by laminated columns, make maximum use of the building material by increasing the moment of inertia of the beam for corresponding increases in bending moment. At the same time, they provide for the necessary pitch of the roof with increase in cross-section toward the center of the span.

Lamella Grid Construction

A new type of prefabricated glued-up Swiss Lamella construction allows the use of small pieces of lumber for the construction of a multitude of grid designs. It uses members laminated perpendicular to and overlapping each other, thus forming a continuous flat or curved grid for various structural members (Fig. 10). Such flat grids have been used for heavy industrial floor constructions and for wall and roof panels. Curved grids have been used for the construction of roof shells, short and long sawtooth roofs with curved and continuous grid panels forming the three-dimensional roof structures.

These grid constructions can be prefabricated or built on the site, and allow the utilization of small dimensions, but call for a relatively large amount of labor. When used for large structures, these grids have the same disadvantage as the long-established Lamella roof construction with diagonal members, as the grids are dimensionally unstable and thus deform with change in moisture content in the wood. Hence in any such grid structure allowance must be made for change in dimensions and shape of the whole structure during and after erection.

Falseworks for Concrete Arch Bridges

In its importance to technological development in the field of civil engineering, the collapse of the 2,800-ft-span Tacoma-Narrows suspension bridge in this country in 1940 is somewhat paralleled by the collapse of the 810-ft fixed wood arch falsework for the world's largest reinforced concrete arch bridge near Sandoe, Sweden, in 1939. In both these cases the span-depth ratios of steel girder and wood truss, respectively, were very small. The ratio of mean height of wood arch to free span of the Swedish bridge was approximately 1:70, with a relatively large deviation of the neutral axis of the wood arch from its center line due to its symmetrical construction. The structure, consisting of 14 nailed arched trusses spaced 2 to 4 ft from center, was floated into position and collapsed during pouring of concrete for the 1-ft-thick lower reinforced concrete plate of the box girder, just before pouring of two remaining sections at the center and of one other section at each quarter point.

The falsework consisted of: (1) approximately 8-in. high continuously curved chords with a width of $36^1/_2$ in. at the center and 43 in. at the foot of the arch, with 2×8-in. timbers nailed to each other to build up the sections; (2) 14 parallel systems of diagonals each consisting of quadruplicate systems of 2×6-in. timbers running in opposite directions; and (3) nailed trussed cross-bracing spaced 13 to 20 ft on centers. The wood used was carefully selected, and was dried to a moisture content that would guarantee tight nails for the connections upon the slight swelling expected to take place in the wood during and upon the erection of the structure.

Principal reasons for collapse of this structure were assumed to be: (1) slenderness of arch, (2) slenderness of both chord members and diagonals, (3) under-dimensioned cross-bracings, and (4) use of excessive design stresses, which resulted in a safety factor of approximately 1.0 upon consideration of the creep resistance of the structure during separate checks on the design by both Swedish and Swiss engineers.

That the conception for the design of this falsework was sound was proved by the successful use of the same type of falsework for the highway and railroad bridge with a span of 590 ft over the Elorn in France (Fig. 11). The falsework replacing the collapsed structure differs from the original falsework in that a trussed arch of different design was employed, which furthermore was supported by 13 pontoon-carried timber trestles (Fig. 12).

Similar but smaller falseworks have been erected in large numbers during the past ten years. Examples are the wood falseworks for the reinforced

concrete arch railroad bridge over the Rio Esla in Spain with a span of 690 ft and for the Swiss railroad bridges over the Aare in Bern with a span of 490 ft and over the Rhone in Geneva with spans of 150, 170 and 190 ft.

The Fuerstenland Bridge near St. Gallen, Switzerland, with two fixed reinforced concrete arch ribs of 430-ft span and 154-ft height, was erected over a wood arch falsework supported by two fan-like trestles built with timbers of 20 percent moisture content and 3- and 6-in. diameter split-ring connectors (Fig. 13). The falsework was provided with a camber of $2^1/_2$ in., yet settled only $1^1/_2$ in. at the center. Each member was prefabricated and the falsework was assembled without previous floor assembly of the individual members. Another outstanding arched falsework is that for the Tara Bridge in Yugoslavia with a span of 380 ft and a height of 460 ft.

Selection of the proper wood, correct utilization of its properties, careful detailing, execution, and erection of the structure are the most important factors for successful construction with wood. The limited resistance to creep of highly stressed timber structures should not be overlooked in design with wood. Swiss engineers call for limitations in stress due to possible creep at 0.6 of the static compression strength. This consideration therefore should be given greater emphasis than limitations due to fatigue in compression or bending at 0.8 of the static strength. Free spans of 825 ft have been considered entirely feasible for wood falsework of nailed or ring-connectored construction. Glued construction systems of the plate-girder or arch type, however, may have to be limited to spans of 300 to 350 ft.

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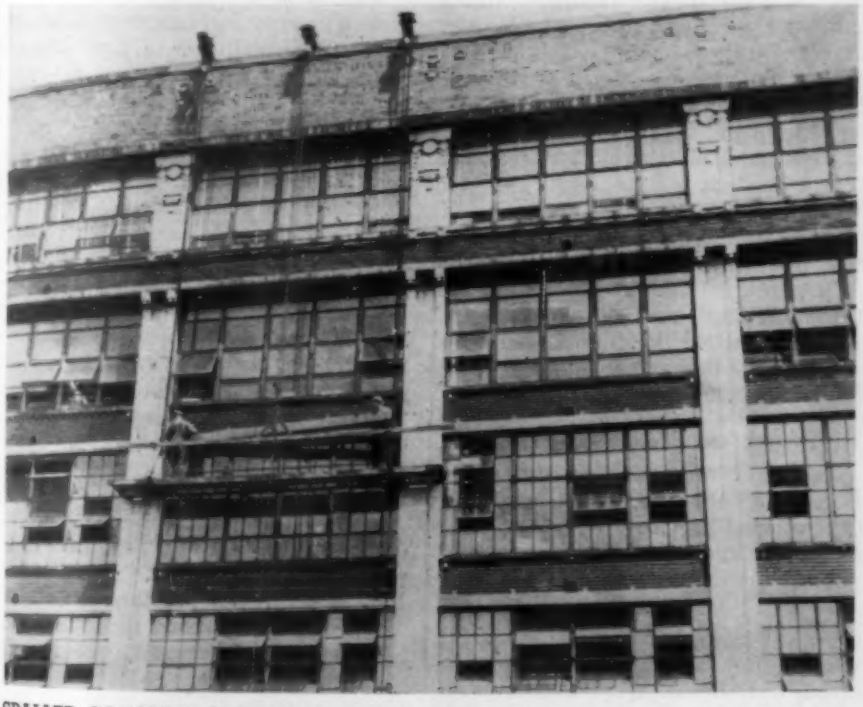
Wrought-Iron Channels Cover Weathered Building Spandrels

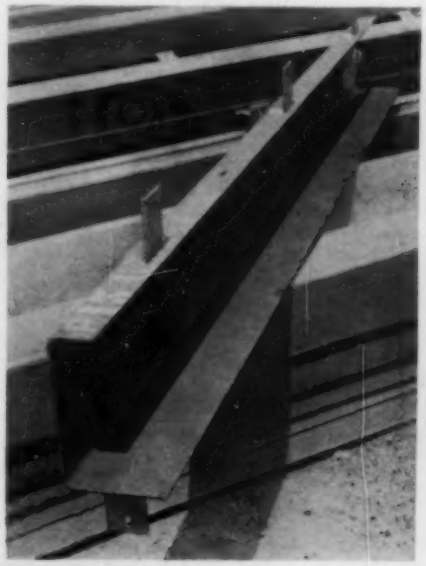
GUIDED BY THE SUCCESSFUL use of wrought-iron plates in protecting submerged concrete piers from damage by water and ice, Milton C. Hartman, Chicago consulting engineer, designed channels of $^3/_{16}$-in.-thick wrought-iron plate to cover severely spalled concrete spandrels of an eight-story building which is occupied by Aldens, a Chicago mail-order firm.

Mortar was chipped out over each spandrel to a depth of $1^1/_2$ in. and a channel slipped into place. Besides "dressing up" the appearance of the building, addition of the wrought-iron spandrels increases its structural strength, according to the installing contractor, Rossbach & Sons, Chicago.

Fabrication of the channels presented a problem because of the bending angle. However, the bend radius of $^3/_4$ in. did not exceed wrought iron's maximum elongation of 14 percent because the axis of the bend was at right angles to the direction in which the plates were rolled. Since the standard maximum width to which such plates are rolled is less than the length required, the channels were fabricated of four lengths welded together.



SPALLED CONCRETE SPANDRELS on eight-story building are covered by wrought-iron channels. Covers are anchored by expansion bolts and well calked.



WROUGHT-IRON SPANDREL COVERS, of $^3/_{16}$-in. plate, are cold bent on $^3/_4$-in. radius to form web $9^1/_4$ in. deep, top leg $1^3/_4$ in. wide to fit over top of spandrel, and lower leg $4^1/_2$ in. wide pitched slightly for drainage. Four $55^1/_2$-in. lengths are welded to form spandrel cover 18 ft 6 in. long.

State Bureaus of Maps and Surveys Aid Planning of Engineering Projects

Enabling Legislation Adopted by Many States

OSCAR J. MARSHALL, M. ASCE
Professor of Surveying and Geodesy,
The Ohio State University, Columbus, Ohio

and MYRON T. JONES, M. ASCE
Consulting Engineer and Surveyor,
Columbus, Ohio

COMPLETE AND ACCURATE MAPS of an area are the first requirement for the planning of any engineering project. Such information is basic, and any incorrect data can be the source of much trouble and expense later. A plan is presented here for a workable organization to collect and distribute surveying and mapping information. The objective of such an organization is to make available the most reliable and detailed survey data.

TODAY WE HAVE MANY ORGANIZATIONS collecting data and preparing maps. The two most prominent and authoritative are the U.S. Coast and Geodetic Survey and the U.S. Geological Survey. The former makes maps of the coastal waters and the Great Lakes, prepares air navigation charts, and provides the most accurate vertical and horizontal control for the making of maps. The U.S.G.S. has made topographic maps of about one-quarter of the country including Ohio. The present quadrangle maps of Ohio have saved many thousands of dollars and have been a great benefit to engineers in preliminary planning.

The Army Engineers have made thorough surveys in areas concerned with flood control and war planning. The AAA has established ground control for aerial mapping. This work consisted of tape or odometer measurements along roads for the purpose of checking the scale of the photographs, in counties where there was only partial or no information available for this purpose. Most public utility companies maintain a special department for surveys and mapping in the territory covered by their operations. Cincinnati, Toledo, Columbus, and Cleveland have made or are making precise surveys to establish vertical and horizontal control for mapping and other purposes. Cleveland is making a map of underground utilities which will show the accurate location of all facilities on one set of master maps. Many mining, railroad, municipal, county and consulting engineers and surveyors have made accurate surveys of areas in which their work called for such information.

The need is, therefore, apparent for a system of surveys and an agency to coordinate, collect and furnish the latest available information for the use of all concerned. A step toward the proper system for the horizontal control of all maps was taken when the Ohio Legislature adopted the Ohio Coordinate System (S.B. No. 299) in 1945.

Almost everyone has need for accurate map information at some time. The following are a few of the organizations or agencies which are constantly and vitally concerned: U.S. Coast and Geodetic Survey, U.S. Geological Survey, U.S. Army Engineers, Agricultural Adjustment Agency, Soil Conservation Service, State Highway Dept., Dept. of Public Works, conservancy districts, drainage districts, county and city engineers, railroads, utility companies, abstract companies, engineers, surveyors, architects, and others too numerous to mention. The need for a coordinating agency in each state is quite apparent.

Purpose and Effect of Legislation

For over one hundred years the U.S.C. & G.S. has been engaged in determining precise geographic positions of thousands of monumented points distributed throughout the country. In 1933 these geographic data were made available to land surveyors and engineers generally by the establishment of the state coordinate systems—a system for each state—the geographic positions being transformed by mathematical processes into plane coordinates (positions on plane surfaces) so that their use involved only the usual methods of land (plane) surveying.

The state coordinate systems provide a means for the scientific location and description of land boundaries. Their use for that purpose has developed an urgent need for legislation designed to give each system an official designation and a legal definition. The legislation will: (*a*) establish the legal status of the state system; (*b*) insure uniformity and definiteness in terms used; (*c*) impose reasonable standards in the use of the systems when the state coordinates become part of the public records.

In recognition of these needs, enabling legislation has been adopted in many states, including Ohio. The formal adoption of the state coordinate systems was urged by the American Bar Association, the American Society of Civil Engineers and the Ohio Society of Professional Engineers.

The legislation provides that the use of the state coordinate system shall be permissive, not mandatory. Used as bases for control surveys, the state system will effect a tre-

SPECIAL TRIPOD permits observer to see over iron fence atop clock tower of Logan County Court House. Quadrangle maps aid engineers in preliminary planning and save State of Ohio many thousands of dollars.

MICHIGAN
LAKE ERIE
PENNSYLVANIA
INDIANA
WEST VIRGINIA
KENTUCKY
OHIO
Toledo
Cleveland
Akron
Youngstown
Canton
Columbus
Dayton
Cincinnati
RIVER
OHIO
42°00' ONE PART IN 14 000 TOO GREAT
41°50' ONE PART IN 35 200 TOO GREAT
SCALE EXACT
41°40' ONE PART IN 139 700 TOO SMALL
41°30' ONE PART IN 30 900 TOO SMALL
41°20' ONE PART IN 19 900 TOO SMALL
41°10' ONE PART IN 16 900 TOO SMALL
41°00' ONE PART IN 16 600 TOO SMALL
40°50' ONE PART IN 19 000 TOO SMALL
40°40' ONE PART IN 27 400 TOO SMALL
40°30' ONE PART IN 8000 TOO GREAT
40°30' ONE PART IN 82 700 TOO SMALL
40°26' SCALE EXACT
40°20' ONE PART IN 13 700 TOO GREAT
40°20' ONE PART IN 48 400 TOO GREAT
40°10' ONE PART IN 34 400 TOO GREAT
40°10' ONE PART IN 16 200 TOO GREAT
40°02' SCALE EXACT
40°00' ONE PART IN 156 200 TOO SMALL
40°00' ONE PART IN 9000 TOO GREAT
39°50' ONE PART IN 29 900 TOO SMALL
39°40' ONE PART IN 19 200 TOO SMALL
39°30' ONE PART IN 16 100 TOO SMALL
39°20' ONE PART IN 15 700 TOO SMALL
39°10' ONE PART IN 17 600 TOO SMALL
39°00' ONE PART IN 24 000 TOO SMALL
38°50' ONE PART IN 55 100 TOO SMALL
38°44' SCALE EXACT
38°40' ONE PART IN 72 600 TOO GREAT
38°30' ONE PART IN 19 500 TOO GREAT
38°20' ONE PART IN 9700 TOO GREAT
10 0 10 20 30 40 50 MILES

FIG. 1. OHIO STATEWIDE COORDINATE SYSTEM adopted by Ohio Legislature is step toward proper system for horizontal control of all maps. Heavy dot-dash line near center of map divides north and south zones.

mendous saving in time and money in preparing specifications for and putting into effect many postwar plans relating to urban and rural land development, in the extension of private business facilities, and in public works construction. It provides a simple control to insure a proper use of those systems.

Why Legislation?

The permanence of land boundary marks, or "corners," the finding of such marks or monuments when they are no longer readily visible, the replacing of them when they have been removed, are mattters which have long been of serious concern to land owners and to others —engineers, lawyers, abstractors— who have of necessity been interested in the occupation, use, or ownership of land. No such marks are truly permanent. All are subject to removal or obliteration, willful or accidental. The only feasible means yet devised to insure permanence of a position of a land corner, as contrasted with the permanence of a physical object which may mark that position, is that for which the Egyptians long ago developed the science of geometry; namely, relating this position to the position of other monuments, by mathematical means, so that if all are not simultaneously destroyed, those that remain can be satisfactorily used to recover the missing positions.

The plane-rectangular coordinates of a point offer a most satisfactory means to this end. The chief bar to their use heretofore has been the lack of any established system of general availability, and the consequent absence of any means of giving permanent or legal significance to their use in a recorded land description. There is nothing new about the use of plane coordinates for surveying field work, mapping or computations. The only new item was the establishment by 1935 of general state systems, so tied to the national

SPECIAL HIGH TRIPOD with Wild direction instrument measures traverse angles where sharp rises in ground make maximum sight distances with normal tripod too short for first-order traverse. Platform on which operator stands is entirely independent of instrument tripod.

triangulation net as to be available for use anywhere in a state within reach of a properly located triangulation or traverse station. Loss of monuments will not prevent the accurate reestablishment of boundary corners whose positions are known in terms of a state system. The work of reestablishment will involve nothing more than ordinary surveying, unless all monuments over a very large area disappear at the same time.

An important step toward facilitating the use of this convenient method of recording the location of property corners is to define officially the name of the state system, so that improper use of, or ambiguous reference to, the state system will be precluded. S.B. No. 299, 1945, does this for Ohio.

New Methods Do Not Eliminate Old

A fact that should be clearly understood is this: The use of state coordinates in land descriptions does not mean the abandonment of the older methods of description, either by platted subdivision or fraction of subdivision, or by metes and bounds. It is intended to supplement either of these methods, and to facilitate the finding, or the checking of the location, of any of the corners implied or described in the older forms of descriptions. It is simply a means of increasing the certainty and facilitating the future field use of the old descriptions, not of superseding them. So, although description by fraction of section is excellent from the point of view of the title examiner, it does not, without outside help from some source, give any assurance that the parcel can be located on the ground. And, after all, that is where the land will finally have to be found. Introducing the coordinates into a deed description may increase the bulk of the description, but the data are worth including. Extra care will be required in transcribing such descriptions to avoid an error in stating a number, but again, the data are worth the extra care required.

Uniformity of Terminology

The extent to which the state coordinate systems can be used for property description, now or in the early future, is still limited. Control stations, with coordinates determined, are not available within reasonable surveying distance from many of the properties to be described. However, as the national survey continues to fill the gaps, it is very desirable that an act defining and naming the system for a state, should be a part of the statute law of the state well in advance of any such use. This would insure, from the very beginning, uniformity of terminology and certainty of meaning of the terms used. It would also impose reasonable standards for, and limitations upon, the use of coordinates for descriptions of boundaries when those descriptions are to become a part of the public records.

Ohio Bureau of Maps Needed

To promote the purposes of this bill and provide a central agency where anyone may obtain all available information, it is necessary that the State of Ohio establish a Bureau of Maps and Surveys. The function of such a bureau should include the following:

1. To gather and permanently file copies of all maps of the state or portions thereof which may be expected to be of use to the Bureau in its work or of value for reference to other agencies or the interested public.

2. To collect and permanently file records of all monumented points which have been established and which may be established to form the statewide survey control system. This shall include data relative to both horizontal and vertical control.

3. To acquaint the many agencies, both public and private, doing surveying and mapping work within the state, with the presence of, and the uses that may be made of the information on file, and the advantages which accrue to the public through the use of the statewide control system.

4. To furnish information in regard to control monuments recorded in the files upon request and supply copies of available maps to interested agencies or individuals at the cost of reproduction.

5. To prepare, adopt and promote the use of standard specifications for surveying and mapping of various classes.

6. To serve to coordinate the efforts of the many agencies—federal, state, county, city and private—making surveys and maps within the

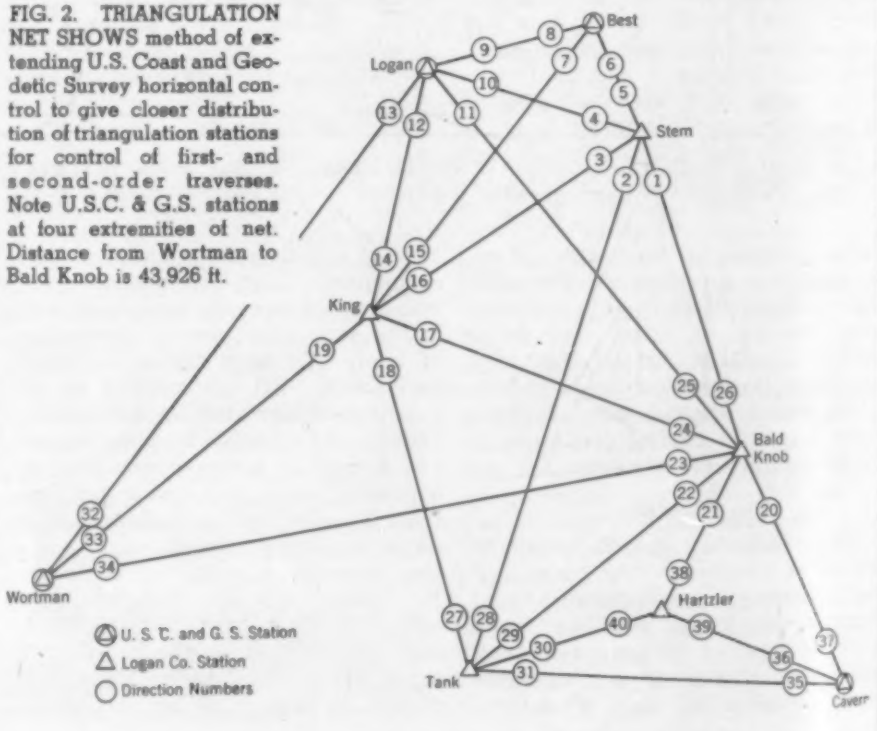


FIG. 2. TRIANGULATION NET SHOWS method of extending U.S. Coast and Geodetic Survey horizontal control to give closer distribution of triangulation stations for control of first- and second-order traverses. Note U.S.C. & G.S. stations at four extremities of net. Distance from Wortman to Bald Knob is 43,926 ft.

state in order to avoid duplication of effort.

7. To expand or elaborate the federal survey control systems to the end that the frequency and accessibility of control points throughout the state will ultimately be closely related to expected relative needs in areas of different population and land value classes.

8. To establish and maintain control survey points determined by the personnel of the Bureau or derived from other surveys made to a standard satisfactory for their inclusion in the Ohio Coordinate System or the network of levels referred to U.S.C. & G.S. datum.

9. To foster and assist in the training of selected members of other qualified agencies which may desire to cooperate with and supplement the work of the Bureau in the course of the normal work of those agencies.

Map users in Ohio are finding the existing U.S.G.S. topographic sheets increasingly inadequate because the scale is too small or the 30-year-old map is out of date. Demands for better maps may soon lead to one or more extensive mapping projects in Ohio. It is very desirable that the Bureau here proposed be set up soon enough to provide necessary control data on a basis which will serve many other purposes as well as that of control for statewide maps—thus avoiding duplicate surveys and additional expense.

It will cost money to establish the control for the coordinate system, and it will be necessary for the state legislature to allot funds for the work. Likewise, it will be necessary for an act to be passed creating the Bureau of Surveys and Maps, which might well come under the Department of Public Works.

The law passed in 1945 was enabling legislation making the Statewide coordinate system legal. No agency was created to make it function and no funds were appropriated to establish the coordinated control. Coordinated stations established in Ohio by the U.S.C. & G.S. are still too far apart for efficient use by the local engineer or surveyor.

The support of all interested agencies and persons is needed to obtain proper action on both matters and it is proposed that meetings be called in the various chapters of the O.S.P.E. and ASCE for the purpose of enlisting the support of all concerned. A publicity campaign should be started in every community.

The authors welcome comments, criticisms and suggestions from all interested parties. The Ohio Coordinate System is a step in the desired direction. However, to serve its intended purpose, it should now be implemented and extended by additional control surveys and mapping properly coordinated and administered by an agency for that purpose.

New York's Tallest Building in Postwar Period

TALLEST BUILDING CONSTRUCTED in New York City in postwar period is 33-story steel-frame structure at north end of Rockefeller Plaza. This T-shaped modern skyscraper, occupying 37,500 sq ft of ground area, will house offices of Standard Oil Co. of New Jersey and will be known as "Esso Building." Traditional "topping out" ceremony for $6,000,000 building took place in March, with members of Bethlehem Steel Co. erection crew fastening American flag to uppermost column, more than 400 ft above street. Building is completely air-conditioned using new principle of separate units every third floor. Carson & Lundin are architects on job, John W. Harris Associates, Inc., general contractors, and Edwards and Hjorth structural steel engineers.

Engineers Ask Congress for Labor Law Amendments

EJC Panel, Representing 100,000, Requests Professional Men Be Freed from Enforced Unionism

ANY LAW which can be used to restrict individual professional effort hinders and restrains professional development, two 80th Congress committees recently were told by an Engineers Joint Council panel representing some 100,000 professional engineers, as one of many reasons why "modifications of existing labor laws are sorely needed."

Panel Appears Before Senate Committee

Led by E. L. Chandler, Eastern Representative of the ASCE, the panel, appointed at the request of EJC (CIVIL ENGINEERING for March 1947, page 51), appeared before the Senate Committee on Labor and Public Welfare on March 4, and before the House Committee on Education and Labor on March 8. Mr. Chandler, as chairman of the panel, represented Engineers Joint Council. He was accompanied by: Gail A. Hathaway, special assistant to the Chief of Engineers, War Department, representing American Society of Civil Engineers, of which he is a vice-president; W. I. Burt, vice-president, B. F. Goodrich Chemical Co., Cleveland, representing American Institute of Chemical Engineers; Clark W. Ransom, General Electric Co., Pittsfield, Mass., representing American Institute of Electrical Engineers; William F. Ryan, Stone & Webster Engineering Corp., Boston, representing American Society of Mechanical Engineers; Dr. Harry S. Rogers, president, Brooklyn Polytechnic Institute, representing the American Society for Engineering Education; and Ritchie Lawrie, Jr., consulting engineer, Harrisburg, Pa., representing the National Society of Professional Engineers, of which he is president. The two last-named are not constituent societies of Engineers Joint Council, but participated in the panel and presentations on invitation of EJC. In addition, Edmund R. Purvis, Director of Public and Professional Relations, American Institute of Architects, accompanied the engineers and made presentations similar in principle on behalf of his organization of professional men.

Heavy emphasis was placed by the panel on two points:

The presentations were not attempting to discuss broad phases of labor relations but confined themselves to the viewpoint of professional personnel, as defined in both S. 360 and H.R. 1754 pending before the Congress.

Engineers are not seeking exemption from provision of the Wagner Act, but amendments to it which will guarantee them appropriate bargaining units comprised of professional men, and only when they choose to organize such units, and which will not compel them to join any organizations as a condition of employment.

Citing past efforts of the various engineering societies and their individual members "to chart courses of conduct which will permit professional employees to enjoy the opportunities apparently intended under provisions of the Wagner Act and to avoid pitfalls into which, from time to time, they have fallen to their detriment," the engineers reported that these endeavors have met "with regrettably little success."

Confusion Deplored

"As a result," the prepared statement continued, "we find that many situations have arisen, and will continue to arise, under present laws where the best interests of professional employees, non-professional employees, and employers alike are not well served. Confusion and conflict with organizations of non-professional employees have developed. Again, the employer of non-union professional engineering employees has been faced with union picketing of construction projects he has designed. We do not believe these developments to be in accord with the intentions of Congress and certainly they are not in the interest of promoting progressive, cooperative relations between employer and employee, nor for the best good of the country."

In stressing the need for distinguishing between professional and non-professional employees, as is done for the first time in both S. 360 and H.R. 1754, the bills now pending in Congress as proposals to amend the Wagner Act, the Engineers' statement declared:

"The National Labor Relations Act was enacted primarily for the benefit of the unskilled and unorganized worker in mass production industry. Cognizance was taken of the status which the skilled craftsman had attained and special provisions were contained for recognizing craft units. Unfortunately, no corresponding recognition was accorded the special problems of the professional employee.

"A fundamental difficulty with the Wagner Act as it affects professional employees is that no distinction is made between professional employees and non-professional employees in spite of the fact that their viewpoints and abilities are inherently different and their conditions of employment cannot be made subject to a common standard.

Professional Viewpoint Stressed

"Professional services are predominantly intellectual and are varied in character. Constant demand exists for originality and creative thought in the solution of problems presented with each new undertaking. Technical skill is only a part of the equipment of a professional person. There is no yardstick by which creative ability can be measured. Individual talents vary and every person possessing a professional attitude constantly strives to expand his knowledge and improve his abilities in his chosen field to the end of personal excellence, personal advancement and the betterment of his profession. Regimentation of professional employees is incompatible with the maintenance of true professional standards. Any law which can be used to restrict individual professional effort hinders and restrains professional development.

"To attempt application of the

(*Continued on page 74*)

Fort Wayne Plans North-South and East-West Expressways

LIMITED-ACCESS EXPRESSWAYS within urban limits have, during recent years, passed from the stage of a designer's dream to that of acceptance as the only completely workable and ultimately satisfactory means of meeting the growing demands for safe, fast, economical mass movement of all types of motor vehicles. Mistakes have been made, as is true of any new development in the trial-and-error stage, but the mistakes have inevitably been on the side of conservatism and inadequacy, never of providing a facility too good or too extensive.

On the basis of a comprehensive analysis, by the State Highway Commission of Indiana, of existing external highways and immediately proposed improvements and additions thereto, of existing street facilities within the city, of traffic origins and destinations, of present and estimated future traffic densities, of directional trends in expansion of business, residential and industrial areas, of traffic benefits and relative costs of alternate improvements and of the general good to the city of Ft. Wayne from such improvements, the following conclusions are reached:

1. That external highway approaches with presently planned improvements will be adequate to urban limits for some years to come, assuming proper maintenance and normal minor improvements as warranted by traffic demands.

2. That an East-West Expressway should be constructed to serve the heavy east-west internal and external traffic as well as interchange traffic from the north-south route.

3. That a North-South Expressway should be constructed to serve the heavy north-south internal and external traffic as well as the interchange traffic from the east-west route.

4. That a proposed connector highway should be constructed approximately on the center line of Fairfax Avenue from the present location of state roads Nos. 1 and 3 to the south traffic circle to serve as a direct connection between these roads and the expressway.

5. That the planned circumferential highway on the north, on approximately the center line of California Road, should be connected into the traffic circle at the north terminus to serve as a collector of traffic from state roads on the north.

6. That state road No. 427 should be relocated to connect into the north-east segment of the traffic circle. This would eliminate two sharp turns on the existing road.

7. That the grades should be separated at the intersection of the two expressways for through traffic, and the interchange traffic handled by a traffic circle separated from through movements.

HIGHWAY PLAN FOR FORT WAYNE, IND., includes north-south and east-west expressways to serve heavy internal and external traffic. Interchange traffic from express routes is handled by traffic circle separated from through movements. Expressway system, with connections to all state routes and with access points for main city streets, is planned to: Insure permanent solution to major traffic problems in Ft. Wayne; reduce vehicular traffic accidents in city approximately 30 percent each year, saving lives and property loss estimated at $400 000 annually; effect reduction in cost of vehicular trips amounting to annual saving of $700,000; replace decadent areas with park-like, landscaped construction; and revitalize business and residential areas.

Engineers' Notebook

Simplified Equations Give Sight Distance on Horizontal Curves

DONALD THOMPSON

Civil Engineer, Bureau of Engineering, City of Los Angeles, Calif.

SIGHT DISTANCE on horizontal curves is one of the most important factors to be considered in the design of a highway. Whenever cut banks or other obstructions to the line of sight occur on the inside of horizontal curves, a standard shoulder 10 ft wide will not provide adequate sight distance when used with minimum-radius curves, which would be safe from a consideration of speed alone. To secure the proper sight distance, the shoulder width must be increased by daylighting the cut, or if it is desired to retain a 10-ft shoulder, curves with radii considerably larger than the minimum must be used.

The formulas in general use at the present time for calculating horizontal sight distance contain trigonometric functions and are inconvenient to use either for direct calculation or for the construction of charts. The formulas also do not apply when the length of curve is less than the sight distance. Since extreme accuracy is not necessary in calculating horizontal sight distance, it is possible to derive approximate formulas which do not contain trigonometric functions and which will be sufficiently accurate for solving any practical problem.

The minimum sight distance that should be provided on any horizontal curve should be at least equal to the minimum safe stopping distance recommended by the American Association of State Highway Officials. (See Table I and Fig. 1.) The line of sight is assumed to be across the long chord of the curve from a height of eye assumed at 4.5 ft, to the pavement surface. The sight distance is measured along the arc of the curve at the center line of the inside lane since this is the distance available for stopping in case of an obstruction on the pavement. The inside lane should always have the full recommended sight distance for the assumed design speed. Traffic lanes are assumed to be 12 ft wide.

TABLE I. AASHO STANDARDS FOR STOPPING DISTANCES

Design Speed, MPH	Stopping Distance, FT
30	200
40	275
50	350
60	475
70	600

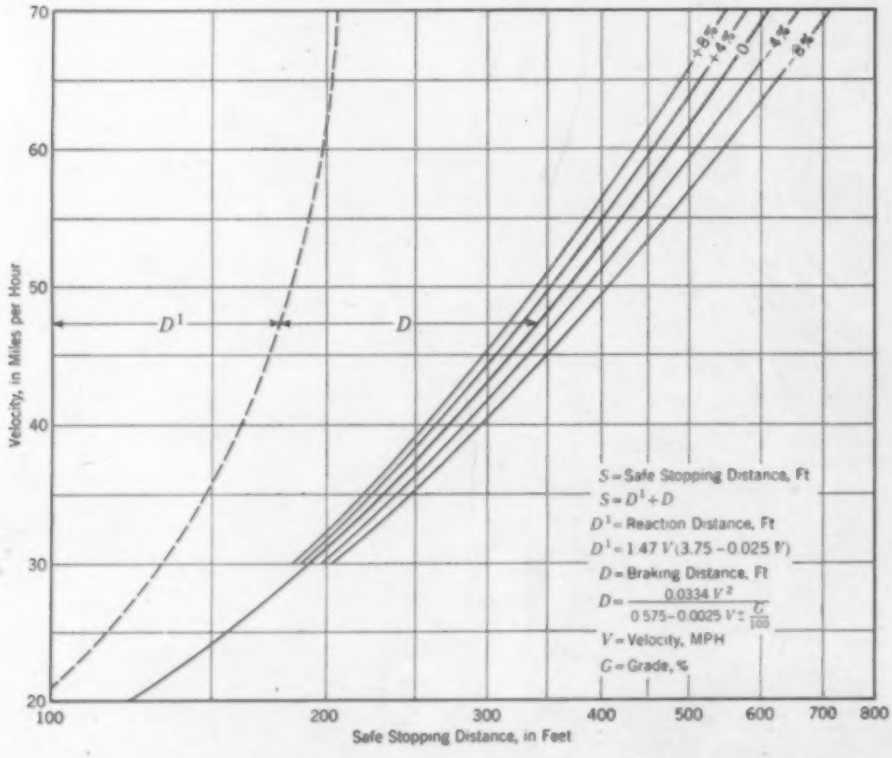


FIG. 1. SAFE STOPPING DISTANCES are diagrammed according to AASHO formula.

The following notation is used:

- S = sight distance in ft
- R = radius of inside edge of pavement, in feet
- D = clear distance in feet from pavement edge to obstruction at height of line of sight
- V = safe speed in miles per hour
- θ = angle subtended by arc of sight distance
- I = central angle of a horizontal curve
- L = length of a horizontal curve in feet

Case 1, When S is Less Than L

In Fig. 2, $D = R - (R + 6) \cos \theta/2$.

The expansion of the cosine is

$$\text{Cos } \theta/2 = 1 - \frac{(\theta/2)^2}{2} + \frac{(\theta/2)^4}{4!} - \cdots$$

where θ is in radians.

Substituting this value of the cosine in the above equation,

$$D = R - (R+6)\left(1 - \frac{\theta^2}{8} + \frac{\theta^4}{16(4!)} - \cdots\right)$$

Also $\theta = \dfrac{S}{R+6}$, in radians.

Therefore $D = \dfrac{S^2}{8(R+6)} - \dfrac{S^4}{16(R+6)^3(4!)} + \cdots - 6$ (1)

Dropping higher powers than the second, the approximate formula is

$$D = \frac{S^2}{8(R+6)} - 6 \quad . \quad . \quad (2)$$

Given a radius of the inside pavement edge of 994 ft and a sight distance of 475 ft, D would equal 22.07 ft by Eq. 1, or 22.20 ft by Eq. 2. This is an error of 1 in 171. Or suppose D is 20 ft and the sight distance is desired for the radius of 994 ft. In this case S would equal 457.08 ft exactly, or by Eq. 2, S would equal 456.07 ft, an error of 1 in 466.

The approximate equation will always give values that are in error on the side of safety. Figure 2 has been calculated from the exact equation and should be used only when S is less than L.

Case 2, When S is Greater Than L

It can be shown that when S is greater than L,

$$D = \frac{L^2}{8(R+6)} - \frac{L^4}{16(R+6)^3(4!)} + \ldots + \frac{S-L}{2}\left(\sin\frac{I}{2}\right) - 6$$

The expansion of the sine is

$$\text{Sin } I/2 = I/2 - \frac{(I/2)^3}{3!} + \ldots .$$

where I is in radians.

Substituting this value of the sine in the above equation,

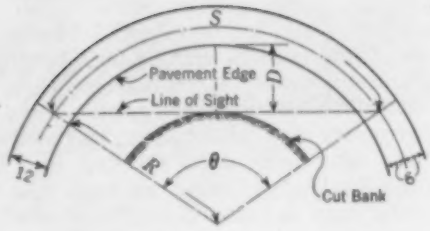
$$D = \frac{L^2}{8(R+6)} - \frac{L^4}{16(R+6)^3(4!)} + \frac{S-L}{2}\left(\frac{I}{2} - \frac{I^3}{8(3!)} + \ldots\right) - 6$$

Also $I = \dfrac{L}{R+6}$, in radians.

Therefore $D =$

$$\frac{2SL - L^2}{8(R+6)} - \frac{4SL^3 - 3L^4}{384(R+6)^3} - 6 \ldots (3)$$

Dropping higher powers than the second, the approximate equation is



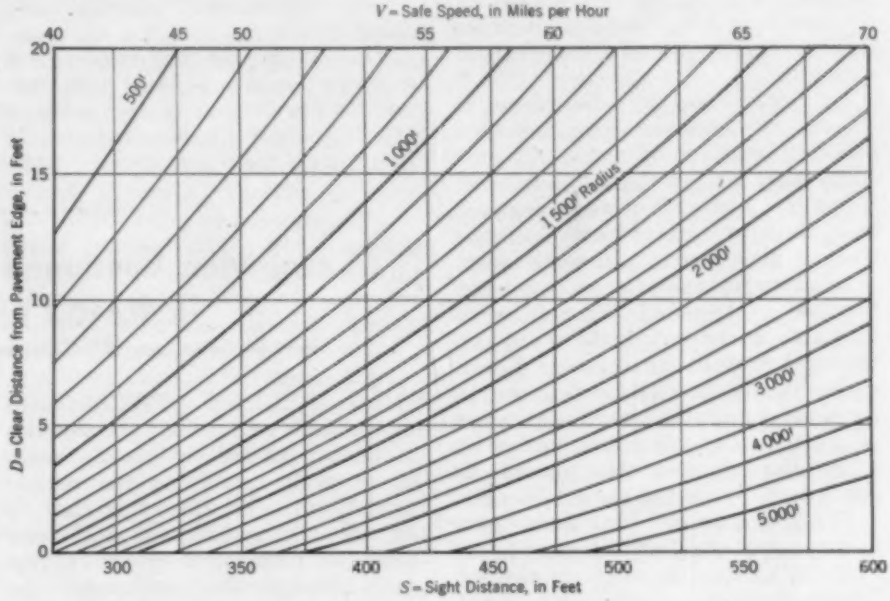


FIG. 2. DIAGRAM OF NON-PASSING SIGHT DISTANCES on horizontal curves is for use only where $S < L$.

$$D = \frac{2SL - L^2}{8(R+6)} - 6. \quad . \quad . \quad . \quad (4)$$

Given a radius of the inside pavement edge of 1,994 ft, a sight distance of 600 ft, and a length of curve along the center of the inside lane of 500 ft, D would equal 15.83 ft exactly, or 15.88 ft by Eq. 4. Or if D is assumed to be 16 ft in this example, S would be exactly 602.80 ft, or 602 ft by Eq. 4.

Shoulder widths on highway plans are usually defined to the nearest foot, while sight distances at critical points should be recorded to the nearest 50 ft. (See AASHO, Policy on Sight Distance, page 21.) Within these limits Eqs. 2 and 4 will be sufficiently accurate for calculating any sight-distance problems, and it is believed that the use of these formulas will be quicker and more convenient than either an exact or a graphical solution.

Torch Shortening Does Not Impair the Strength of Eyebars

SHORTENING EYEBARS BY UPSETTING after they have been heated with oxyacetylene torches does not materially affect either the static or fatigue strength of the bars. This, briefly, is a summary of the results of fatigue tests of shortened and unshortened eyebars contained in a Preliminary Report of Committee 15—Iron and Steel Structures—of the American Railway Engineering Association.[1] The tests, made at the University of Illinois under the direction of Wilbur M. Wilson, M. ASCE, Research Professor of Structural Engineering, were a part of the program of the Committee on Fatigue Testing (Structural)[2] of the Welding Research Council of Engineering Foundation, of which Jonathan Jones, M. ASCE, chief engineer, Fabricated Steel Construction, Bethlehem Steel Co., was chairman. The tests were planned by the Subcommittee on Bridge Reinforcement of which J. E. Bernhardt, M. ASCE, bridge engineer, Chicago & Eastern Illinois Railway, was chairman.

It is estimated by the Association of American Railroads that, if the method of upsetting the bars when heated were used in tightening all loose eyebars in bridges that should be tightened, the resulting saving would be approximately a million dollars a year.

Not only does the method of shortening eyebars by upsetting when hot result in a shortened eyebar of unimpaired strength, but the process is

[1] The Shortening of Eyebars to Equalize the Stress, Preliminary Report of Committee 15, Iron and Steel Structures: Bulletin 460, American Railway Engineering Association, June–July 1946, p. 1.

[2] The work of this committee was participated in by the Public Roads Administration, Federal Works Agency; Chicago Bridge & Iron Co.; Association of American Railroads; and the Bureau of Ships, Navy Department.

cheaper and quicker then other methods that have been used. Moreover, this method can be used with less interruption to traffic than other methods that have been tried. Furthermore, the alternative methods that have been used resulted in a considerable reduction in both the static and fatigue strength of the member, whereas eyebars shortened by upsetting when hot retain practically their full static and fatigue strength.

As background for the research, the report states that pins and pinholes in eyebars of many old pin-connected bridges have been subjected to a high rate of wear resulting from the operation of heavy locomotives at high speeds. In some spans of this type, many of the eyebars have become so loosened through wear that they carry very little, if any, of the total stress in the member. Loose eyebars have been known to rattle for several minutes after the passage of a train. In some cases one bar of a two-bar member has carried as much as 97 percent of the total load.

"Various methods have been used in the past in an effort to tighten loose eyebars," the report continues. "Probably the most common of these was a method involving the cutting of the member and the welding or riveting of plates or bars to it in such a manner that a turnbuckle could be applied for take-up and adjustment. This method is not only relatively expensive, but will develop in fatigue not more than 35 percent of the fatigue strength of the original section of the eyebar.

"Another method which has been used to shorten eyebar tension members is to cut a short section out of the bar and then draw the two sections of the bar together so that the heads come in contact with the pins. The two sections of the eyebar are then spliced by welding on, or welding and riveting on, plates on both sides of the bar. The objection to this method is that very little dead load or initial stress can be placed in the bar; and here again the detail will develop in fatigue not more than 50 percent of the fatigue strength of the original section of the eyebar.

"The method which appears to be the most practical for tightening loose eyebars is to heat a small section of the bar to cherry red and then upset this heated part by special clamps. This method was first used on American railroad bridges in 1916. An especially built charcoal furnace, enclosing the eyebar to be shortened, was used, and after heating a short length of the bar, it was upset by means of clamps and clamp bolts."

The principal objection to this method according to the report, was that the charcoal furnace was cumbersome and it required considerable time to heat the bars. However, this method was used for many years by several of the railroads with results which have withstood the tests of increased locomotive weights and higher speeds.

"During the past few years several of the railroads have used oxyacetylene torches instead of the charcoal furnace to heat the required area of the eyebar," the report stated. "The use of these torches has not only reduced the time required to heat the eyebar to the desired temperature, but also insures a more uniform temperature of the heated area."

"The flame shortening of eyebars does not have any appreciable effect on either the fatigue or the static strength of the bars," the report concludes. "The equipment required is standard for bridge and building gangs, with the exception of the clamps and a pyrometer. Costly train delays are eliminated as only one hour is required to complete the work on one bar."

Level-Men Cautioned on "Waving the Rod"

HOWARD S. RAPPLEYE, M. ASCE
Senior Mathematician, U.S. Coast and Geodetic Survey, Washington, D.C.

SOME RECENT TEXTBOOKS and manuals recommend the practice of "waving the rod" in leveling, without properly qualifying the recommendation. The theory is that, if the rod is waved toward and away from the instrument in a vertical plane through the instrument, the minimum rod reading is that obtained when the rod is vertical and is the true reading. This is strictly true if the point about which the rod is swung is the actual zero of the graduations. However, when the rod is leaned backward, away from the instrument, it swings about the back edge of the foot of the rod and the zero of the graduations jumps up, giving a "false minimum," which can, under certain conditions, introduce serious inaccuracies in the leveling.

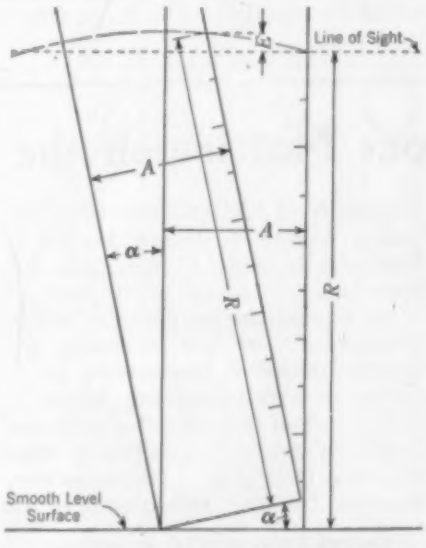


FIG. 1. SERIOUS INACCURACIES in readings are introduced when rod is waved or rocked away from instrument.

TABLE I. ERRORS IN ROD READINGS

R (ft)	α	E (ft)	$E/\cos\alpha$ (ft)
0.2	36°52′	0.0500	0.0625
0.5	16°42′	0.0220	0.0230
1.0	8°32′	0.0112	0.0113
3.0	2°52′	0.0037	0.0037
5.0	1°43′	0.0023	0.0023
7.0	1°14′	0.0016	0.0016
10.0	0°52′	0.0012	0.0012
13.0	0°40′	0.0008	0.0008

The sketch, Fig. 1, shows clearly what happens when a rod is standing on a smooth level surface and is waved or rocked away from the instrument.

Let R = the true reading when the rod is held in a vertical position.

Let A = the front-to-back dimension of the foot of the rod.

Let α = the angle through which the rod is waved or rocked.

Let E = the amount by which the graduation, on which the true reading is made when the rod is vertical, moves upward as a result of waving the rod about the back edge of its foot.

Then: $E = A \sin\alpha + R\cos\alpha - R$

Differentiating with respect to α and equating the differential to zero, we find that E is at its maximum value when α is such that

$$\tan\alpha = A/R$$

Assuming A = 0.15 ft (approximately the front-to-back dimension of the foot of a standard Philadelphia rod) and letting R assume values as shown in the first column of Table I, we find E to be a maximum for the values of α shown in the second column of the table.

(*Continued on page 76*)

...THE READERS Write

A Junior Finds Hope in Proposed ASCE Constitutional Amendments

DEAR SIR: I am a Junior in the American Society of Civil Engineers. Having read the article, entitled "Petitions Circulated for Constitutional Amendments," by Col. William N. Carey, ASCE Executive Secretary, in the March issue of CIVIL ENGINEERING, I want more than ever before to retain my association with the ASCE.

I have had the feeling too many times in the past, and I know I'm not alone in the ranks of the Juniors when I say this, that the Society, represented by the Corporate Members, has more or less tolerated us as one would a stray puppy that has followed him home.

In the past few years, the growth of membership among the Juniors has increased at such a rate that they now constitute approximately one-third of the total membership of the Society. I believe the predominant reason for this increase in membership among the younger men in the engineering field is the ever-expanding *professional* interest and activities of the ASCE in such fields as labor relations, minimum wages, and professional recognition for technically trained men, etc.

Yet, despite the non-purely technical advances that have already been made in the engineering field, many of which have been achieved wholly through the efforts of the ASCE, there has always been the feeling among the Juniors that "this is too good to last."

For many years the older men have talked about doing something for the younger members. These were statements that most of us have always taken with a "grain of salt." But now, after reading Colonel Carey's article and the editorial in the same issue, it appears that something is on the verge of being done about us.

Secretary Carey's presentation hits the nail on the head, and I hope that all Corporate Members will see as he does the interrelation of these two issues—increasing dues and giving Juniors the vote—and will realize that only by authorizing the expenditures required to carry on the professional activities of the Society, and by furnishing the wherewithal with which to do so, can they hope to retain the interest of the present Juniors and attract future generations of Juniors, and that they will be professionally minded enough to vote "yes" on *both* amendments later this year.

S. RALPH ANGELL, JUN. ASCE

New York, N.Y.

Methods of Computing Vertical Curves Reviewed

DEAR SIR: Although the method of computing elevations on a vertical curve, given by N. W. Pettijohn in the February issue, is an improvement on the abstruse method to which he refers, it is still too involved and time-consuming, especially with the method he gives for computing E, the tangent offset at the middle of the curve.

There is no need of computing E, since the tangent offset per chord for this curve is, as always, one-half the chord offset, which is the rate of change per chord. Since there are 20 chords and the gradient changes from a -1.0 per 50 ft to a $+2.0$, or a total of 3.0, the rate of change per chord, 50 ft, is $3.0/20 = 0.15$, which is the chord offset and the tangent offset is one-half that, or 0.075, which he calls 0.08 for the first point on the curve. Since offsets vary as the square of the distance, that at the sixth point would be $36 \times 0.075 = 2.70$ and that at the tenth point, or center of the curve, would be $100 \times 0.075 = 7.50$, both of which values check with Mr. Pettijohn's.

Wellington, in his *Economic Theory of the Location of Railways*, p. 387 (1887), uses the well-known property of the parabola that the curve bisects the distance from the P.I. to the long chord, but this, while easier to use, is just as unnecessary as Mr. Pettijohn's method. In fact, the change of gradient per chord is usually assumed and the length of the curve found, so that even the foregoing computations need not be made. The length of the curve in chords is the total change in gradient divided by the change per chord, and one-half of it goes on each side of the intersection of the gradients.

For many years, I have wondered why both students and practicing engineers have any trouble with the computation of elevations on vertical curves. I have concluded that it is because no one, so far as I remember, has pointed out specifically that vertical and horizontal curves are exactly alike and are run in by exactly the same methods.

The most common method is that used by Mr. Pettijohn, which may be called the parabola, or tangent offset, method. On location, working with the late Prof. C. L. Crandall, I have put in hundreds of flat, simple curves by this method, using the well-known approximate formula, $t = 7/8\ n^2D$, in which t is the tangent offset, n the number of stations, and D the degree of the curve. This practice saves time for the transitman, the busiest man in the location party. For vertical curves, the only difference is that the tangent offset per chord length is one-half the change of gradient per station, as shown above, and chords of any length may be used with the gradients expressed in feet for that chord length.

There are, however, two major disadvantages of this method. The first is the time it takes to compute the elevations of all points on the tangents as well as the offsets, though the latter may be computed quite rapidly if it is recognized that the offset for, say, the sixth point is four times that for the third, and that for the ninth is nine times that for the third and so on. The other disadvantage is that there is no check on any of the results.

Hence both Crandall, in his book *Railroad Engineering* (about 1885), and Wellington, in the work referred to, give, in addition to the above method, another which does not require computing the elevations of points on the tangents except at the B.V.C. and E.V.C. and in which all computations are automatically checked by closing in on the E.V.C. with the correct elevation. This may be called the chord offset method, since it depends on the fact that the change of gradient per chord is the chord offset and the tangent offset is one-half that amount.

The chord-offset method is rarely used for horizontal curves, except for replacing two or three stakes which may have been disturbed by construction operations, but it is given in all the field books. For horizontal curves, it is essentially a field method and nothing except the chord offset itself can be computed in advance. But for vertical curves, the directions of the chords are fixed by their gradients and the entire curve may be computed in advance—in fact, should be in order to secure the check on the computations mentioned above.

For curves beginning at chord points,

it is necessary only to change the gradient of the first chord from that of the tangent by the tangent offset, then change the gradients of the succeeding chords by the chord offset. For curves starting at plusses, as indicated by both Crandall and Wellington, it is best to find the elevations of two successive points by the parabola method, use these to find the gradient of the chord, and then proceed as before. Of course, the checking in this case will involve finding the tangent offset for the subchord by the parabola method and then working to tangent and along tangent to E.V.C. Even this checking is the same as for horizontal curves where T.C.s and C.T.s are put in from the P.I. and the curve run by deflections is checked on the C.T.

The above method may be verified by computing the gradients for the successive chords by using Mr. Pettijohn's values, though one more place of decimals would be required to give exact values.

FRED A. BARNES, M. ASCE
Prof. of Railroad Eng.
Emeritus, Cornell Univ.
Ithaca, N.Y.

"Old Cowhand" Checks Vertical Curve Solution

TO THE EDITOR: A few days ago an old cowhand found himself engaged in connecting two intersecting grade lines with a 1,000-ft vertical curve. The grades of the intersecting tangents were −2.0 percent and +4.0 percent. Unfortunately, the old cowhand had left his field manual in camp some ten miles away and had little or no recollection of the formula for a parabola, an ellipse, a hyperbola, or other form of vertical curve. In this case, as in almost all other engineering problems, the work could not be delayed. Some form of vertical curve had to be devised.

After due cogitation, the old cowhand decided that the curve, when completed, would consist of twenty 50-ft chords with 21 points of intersection. The difference in the rate of grade of the adjoining chords would be uniform. However, the deflection at the point of curve and point of tangency from each tangent would be only half the deflection between the intermediate and adjoining chords. With the adoption of a standard length of station of 50 ft instead of 100 ft, the grades of the tangents became −1.0 percent and +2.0 percent instead of −2.0 percent and +4.0 percent.

In moving from the point of curve to the point of tangency along the vertical curve, one would change his direction of travel which, on this earthbound sphere, would be the equivalent of a change from going downhill one foot for each 50 ft, to going uphill 2 ft for each 50 ft. It was at once quite evident that the rate of grade of each of the 18 intermediate chords would account for 0.15 percent of the 3.0 percent change in grade, and that the two extreme chords would absorb the remainder—.075 percent each.

The old cowhand at once computed the rate of grade for each of the chords, observing that the grade for a respective chord subtracted or added to the elevation of the last point of intersection would give the elevation of the next point of intersection. Knowing the elevation of the point of curve and point of tangents, it became a very easy task to determine the elevation of all the other points on the vertical curve. In order to keep a record of what was done the old cowhand jotted down on the back of an envelope the station numbers, the elevation of the stations, and the rate of grade of each chord.

That night after supper the old cowhand pulled off his boots and, in the few minutes that he had before retiring, picked up his current issue of CIVIL ENGINEERING (February 1947). Much to his surprise, he found that N. W. Pettijohn had described the method of computing a vertical curve for intersecting grades of −2.0 percent and +4.0 percent for a 1,000-ft curve identical with that of the old cowhand. Being interested in the accuracy of his computations, the old cowhand compared the results of this article with those he had jotted down. Table I gives his computations, as compared with those appearing in Mr. Pettijohn's article (p. 88).

As the old cowhand gazed into the smoldering fire, there came the thought that this was a good example of the value of understanding the true nature of every problem one encounters.

JOHN S. WORLEY, M. ASCE
(*The Old Cowhand*)
Ann Arbor, Mich.

TABLE I. COMPARISON OF AUTHOR'S COMPUTATIONS WITH MR. PETTIJOHN'S

STATION	V.C. POINTS	GRADE DATA PERCENT	PROFILE	PROFILE FROM PAGE 88
557		−1.000	581.00	581.00
+50		−1.000	580.30	580.30
558	B.V.C.	−1.000	579.30	579.30
+50		− .925	578.38	578.38
559		− .775	577.60	577.60
+50		− .625	576.98	576.98
560		− .475	576.50	576.50
+50		− .325	576.18	576.18
561		− .175	576.00	576.00
+50		− .025	575.98	575.98
562		+ .125	576.10	576.10
+50		+ .275	576.38	576.38
563	P.I.V.C.	+ .425	576.80	576.80
+50		+ .575	577.38	577.38
564		+ .875	577.10	577.10
+50		+1.025	578.98	578.98
565		+1.175	580.00	580.00
+50		+1.325	581.18	581.18
566		+1.475	582.50	582.50
+50		+1.625	583.98	583.98
567		+1.775	585.60	585.60
+50		+1.925	587.38	587.38
568	E.V.C.	+2.000	589.30	589.30
+50		+2.000	591.30	591.30
569		+2.000	593.30	593.30

Asks Dues Adjustment in Metropolitan Area

TO THE EDITOR: The proposal of the Board of Direction for increasing dues presents an opportunity to eliminate a long-standing injustice. As a carry-over from bygone days, members residing in the New York City metropolitan area, District 1, have been paying $5 per annum more than others, although conditions justifying the extra payment no longer exist. The amendment raising dues can right this wrong by making dues independent of residence.

Reasons for abolishing the discriminatory charge follow:

1. It is a traditional carry-over from the days when monthly meetings of the Society were held in New York City. Since such meetings are no longer held here, justification on these grounds no longer exists.

2. Although the Annual Meeting takes place in New York City, the advantages resulting from holding the meeting here that formerly accrued to members of District 1 have been offset by the fact that the Society now holds three regional meetings, which in technical character are on a par with the Annual Meeting, each year in places other than in New York City. These meetings include the Annual Convention. Members residing in District 1 currently contribute to the cost of these meetings in larger proportion than do other members, although they get proportionately less rather than more from them.

3. With the establishment of regional offices, the expenses for which are borne by the Society as a whole, even less justification exists for the added levy on the New York metropolitan area.

4. Few residents of the New York metropolitan area use the Headquarters of the Society, whereas members from out of town frequently take advantage of its facilities. The library, only part of whose expenses are paid by the Society, is used by members and non-members alike, and a good part of its work involves lending books or answering questions by mail.

5. Many residents of the metropolitan area live too far from Society Headquarters to utilize its facilities any more than do members outside the area.

Since a constitutional amendment, requiring a petition from each of the four Zones signed by 75 Corporate Members, is needed, members in District 1 are outnumbered. They can only appeal to the fairness of fellow members.

The inequity can be rectified by amending Article IV of the Constitution by dropping Section 3 and changing Section 2 to read:

"2. The annual dues payable by members shall be as follows: by Corporate Members, twenty-five dollars; Affiliates, twenty-five dollars; Juniors, twelve dollars and fifty cents prior to the age of thirty-two, thereafter increasing at the rate of two dollars and fifty cents per year, for three years."

F. S. MERRITT, Assoc. M. ASCE
Asst. Editor, "Engineering News-Record"
New York, N.Y.

Narrows Bridge Held No Navigation Hazard

TO THE EDITOR: After reading the article, "War Department Determines Bridge Clearances for Public Navigation," by Lt. Gen. Raymond A. Wheeler, in the February issue, the writer feels confident that when the proposed Narrows (suspension) bridge project (from Brooklyn to Staten Island) comes before the War Department for consideration, the depth of water in the Narrows will free the project from the military objections existing in the case of the proposed Brooklyn-Battery bridge. Objections to the latter structure, of course, are based on the possibility of the channel's being entirely blocked in time of war by wreckage of the bridge.

Wreckage of the proposed Narrows bridge, however, would not block the Narrows because of the depth of the channel, which could easily absorb the wreckage and still leave navigation unobstructed. Furthermore, experiences in World War II—such as the opening of the European harbors that had been wrecked and deliberately obstructed by the Germans—prove that any obstructions are readily removed.

As the East River bridges are built at sea level, with an approximate vertical elevation of 135 ft above high water, they are not ample for the unrestricted passage of any ship afloat. The site at the Narrows gateway to New York Harbor is the ideal location for the proposed bridge crossing for many reasons. The most important of these reasons is that the natural high elevation of over 100 ft above sea level on both sides of the Narrows makes unnecessary the construction of approaches such as would be required if the bridge were built at water level, as in the case of the approaches of the East River bridges.

Furthermore, the channel depth at this location is approximately 100 ft. The proposed underclearance is 235 ft above high water, a clearance that would accommodate the highest vessel on record. There is a proposed clear span between towers of 4,620 ft without intermediate piers, and without any obstruction to navigation. These proposed horizontal and vertical clearances are far in excess of those allowed for any bridge structure in the world and should certainly satisfy any possible requirements of the Navy and any navigation interests.

THEODORE BELZNER, Affiliate ASCE
Brooklyn, N.Y.

Urges Accrediting of Engineering Employers

DEAR SIR: I have just reread Mr. McDonald's article "Labor Peace, Professional Independence Seen If Employers Are Accredited," in the January issue.

On first reading my impression was, "A good idea, but nebulous and probably not very effective." On rereading however, I see it is specific and comprehensive, and can probably be made effective within two or three years.

I want to thank Mr. McDonald for having set forth an idea which may be extremely important and valuable to the profession, and strongly urge that the idea be fully presented for discussion to the appropriate committees. With most other engineers, I have watched with much foreboding the absorption of more and more engineers in labor unions, and this seems like the answer.

In an extremely high percentage of cases engineers do, and in the nature of the case must continue to, work on a salary basis and in close functional contact with the foremen and mechanics who execute our designs. Thus a detached, professional attitude is harder to maintain and, consequently, even more vital to both the individual and the profession.

I hope to see Mr. McDonald's idea expanded.

C. C. MUHS, M. ASCE
Chicago, Ill.

Bravery of ASCE Man at Bataan Is Recalled

DEAR SIR: This is in reference to Maj. Gerald Henry Hoffman, Assoc. M, Army Corps of Engineers, who died in the Philippines in May 1942 and was posthumously awarded the Silver Star for gallantry in action in the Battle of Bataan, as mentioned in the "Deceased" department of the October issue.

Major Hoffman deserves more than the award given him. The success of the 1st Engineer Battalion (PA) in accomplishing its mission during the last few days of the Battle of Bataan was, in large measure, due to the untiring and ceaseless efforts of Major Hoffman and the Filipino engineer officers and men who worked with him.

Day and night, while under constant enemy fire, Major Hoffman—together with Lt. Harriet Stewart of Texas—assisted the writer in planning and supervising the construction of mine fields and anti-tank obstacles along the 1st Regular Division front of five miles. At the fall of Bataan on April 8, 1942, Major Hoffman and Lieutenant Stewart, along with most of the engineer officers and men of the 1st Engr. Battalion (PA), surrendered to the Japanese forces on orders of the higher command. Fearing that the Japanese would kill Major Hoffman and Lieutenant Stewart because they were Americans, the writer managed to have them escape to join Col. Lee Berry.

After the infamous "death march" from April 10 to April 13, the writer saw Lieutenant Stewart in the concentration camp at Capas, Tarlac, and inquired concerning the fate of Major Hoffman, who had been with him at the time of their escape from Bataan. Lieutenant Stewart informed the writer that the Japanese had taken Major Hoffman, used him as truck driver, and brought him back to Bataan to help them clear the mine fields we had planted along the 1st Division front. This was the last information I had of him, and it seems probable that he was killed by the Japanese after he had cleared the mine fields.

Major Hoffman was one of the finest American soldiers I met in the battlefields of Bataan. Every inch a gentleman and a capable engineer officer, he was greatly admired by all the officers and men of the 1st Engineer Battalion (PA) while on duty along the front line. Helping us carry the dangerous mines, he would walk to a point about 200 yd in front of the front line and help us plant them while under constant enemy fire. He and Lieutenant Stewart stuck with the sick and dying engineers to the last.

JOSE A. BERNALES
Colonel, 0-1497 C E, (PA) Former C.O., 1st. Eng. Bn., PA
Manila, P.I.

SOCIETY NEWS

EDITORIAL:

"The Predominant Reason"

WORTHY OF THE ATTENTION of every Corporate Member of ASCE now weighing the combined issues of granting the vote to Juniors and increasing Society dues is the letter to the editor from S. Ralph Angell, Junior, ASCE, which appears on page 49 of this issue. Here is an expression of the younger engineer's views that is as challenging to the older Society member in its straightforwardness as it is enthusiastic in its youthful hopefulness for, and confidence in, the profession.

"I want more than ever before to retain my association with the ASCE," writes Mr. Angell, as a result of the possibility that, by constitutional amendments, Juniors will be enfranchised and, with the aid of increased dues revenue the Society will continue its progress along the path of professional activities pursued in recent years. It is significant that it is "the ever-expanding professional interest and activities of the ASCE" that Mr. Angell hails as "the predominant reason" for the increase in membership among the younger men in the engineering field.

He cites the feeling he has had in the past "that the Society, represented by the Corporate Members, has more or less tolerated us (Juniors) as one would a stray puppy that has followed him home." He discloses that even while the Society is engaged in its relatively new activities—"labor relations, minimum wages and professional recognition for technically trained men, etc."—" there has always been the feeling among the Juniors that this is too good to last." He states frankly that while "for many years the older men have talked about doing something for the younger members," these were statements "that most of us have always taken with a grain of salt."

What, then, is the foundation upon which he builds his desire "more than ever before to retain my association with the ASCE?" It is his trust in the older members of the Society. For he concludes from the proposed constitutional amendments that "something is on the verge of being done about us."

That is a fine compliment to the older members of the Society. It is a tribute to their farsightedness, which this Junior, and undoubtedly many others like him among the 6,500 in the Society, accept as a foregone conclusion, even though the balloting on the proposals is still some months distant.

"I hope," writes Mr. Angell, "that all Corporate Members will see the interrelation of these two issues and will realize that only by authorizing the expenditures required to carry on the professional activities of the Society, can they hope to retain the interest of the present Juniors and attract future generations of Juniors, and that they will be sufficiently professionally-minded to vote 'yes' on both amendments later this year."

Here, then, is the challenge of the Society's younger men—those more closely concerned with and affected by the professional activities of the Society—to the older members whose duty it is to perpetuate the profession. Here is ready recognition that the expanding responsibilities the Society has undertaken in the professional behalf of its members, together with the diminishing dollar purchasing power now being encountered on all sides, require an increase in revenue if those activities are to be continued. Here is the younger engineer's frankly-stated view that it is not enough for his Society merely to provide him with good tools, in the form of outstanding technical training and engineering knowledge, but that he also expects it to strive jointly with him for a proper environment in which he can utilize those tools advantageously—an environment of professional recognition.

This Junior apparently is confident that the Corporate Members, the only members now empowered to vote, will accept as axiomatic the fact that present progressive policies cannot be continued without additional revenues, and that the proved productivity of the current ASCE policies—greater attention to the professional phases—will be upheld by a vote of the membership. Mr. Angell, Junior, ASCE, has well classified those policies as "the predominant reason" why many young civil engineers highly value their ASCE membership.

State Department's New Educational Bill Obviates Objections of ASCE Board

CERTAIN PHASES of the so-called Bloom Bill which, as HR 4982, failed of passage in the 79th Congress, are improved in comparable legislation which the State Department has prepared for introduction in the current session of Congress.

At its meeting in January, the ASCE Board of Direction adopted a resolution approving the broad purposes of such legislation—interchange of persons, knowledge and skills through travel and education; rendering of technical and other services to other governments on a reimbursible or shared-expense basis; and dissemination abroad of public information about the United States, its people and its policies. The resolution, however, opposed preparation of engineering designs, plans and specifications for, or the engagement in supervision of, construction of projects for foreign governments by domestic governmental agencies except when "the national interest demands otherwise."

Members of the Board recently conferred with officials of the State Department on invitation, and a mutually satisfactory understanding was reached. As a result, an entire new section, enunciating a policy governing technological services, has been written into the bill the State Department prepared for introduction in Congress. This section would place Congress on record as declaring specifically that:

"The Secretary of State shall promote by appropriate means the performance of technological services to foreign governments by qualified private American individuals and government agencies.

Mutual Benefit Stipulated

"If technological services are rendered by a government agency, they shall be of mutual benefit to the United States and the other government, and shall demonstrate United States technical achievements or the special competence of a government agency, the services being of an advisory, investigative, or instructional nature, or a demonstration of a technical process, or a preliminary survey, or report, and shall not include overall technological services or the supervision of construction work except as may be incidental to such investigation, instruction or demonstration.

"A government agency shall render engineering services related to engineering works only when the Secretary of State shall determine that the national interest demands the rendering of such services by a government agency.

"Technological and other services shall not be undertaken for a foreign government if, in the opinion of the head of the U.S. Government agency concerned, such services will impair the fulfillment of domestic responsibilities of that agency.

"Foreign governments shall pay the full cost of technological services, or, at the discretion of the Secretary of State, the cost shall be shared through contributions of personnel, facilities or cash."

As a result of the mutually satisfactory understanding that has been brought about between the Board and the State Department, by means of conference and correspondence, it is expected the new legislation will make it clear that it is the intent of Congress that the State Department shall invite outstanding citizens within and outside of government service and who are technologists particularly competent in the various fields of applied science, to review and advise on the government's international technological activities.

The bill prepared by the State Department is titled "Educational Interchange and International Information Act of 1947," and its objectives, of which the ASCE Board of Direction's resolution approves, are stated to be:

"To enable the Department of State to promote mutual understanding between the United States and other countries, which is one of the essential foundations of peace, and to correct misunderstandings and distortions about the United States in other countries, which constitute obstacles to peace."

As prepared for introduction, the bill contains the following language as a result of the ASCE-State Department conference:

Part B. Technical and Other Services

"Sec. 411. A Government agency, at the request of the Secretary, may perform such technical or other services as such agency may be competent to render for the government of another country desirous of obtaining such services, upon terms and conditions which are satisfactory to the Secretary and to the head of the Government agency, when it is determined by the Secretary that such services will contribute to the purposes of this Act. However, nothing in this Act shall authorize the performance of services relating to the organization, training, operation, development, or combat equipment of the armed forces of a foreign government.

Policy Governing Services

"Sec. 412. In authorizing the performance of technical and other services under Section 411 above, it is the sense of the Congress: (1) That the Secretary shall encourage through the Government agency with appropriate legislative authority the performance of such services to foreign governments by qualified private American individuals and agencies; (2) that if such services are rendered by a Government agency, they shall demonstrate the technical accomplishments of the United States, such services being of an advisory, investigative, or instructional nature, or a demonstration of a technical process; (3) that such services shall not include the construction of public works or the supervision of the construction of public works, except as may be accessory to such investigation, instruction or demonstration, and that under authority of this Act, a Government agency shall render engineering services related to public works only when the Secretary shall determine that the National interest demands the rendering of such services by a Government agency, but this policy shall not be interpreted to preclude the assignment of individual specialists as advisors to other governments as provided under Title III of this Act, together with such incidental assistance as may be necessary for the accomplishment of their individual assignments; (4) that such services shall not be undertaken for a foreign government if, in the opinion of the head of the Government agency, such services will impair the fulfillment of domestic responsibilities of that agency; and (5) that the Department shall invite outstanding leaders, both within and outside the Federal Government, in the various fields of engineering in the United States to review and advise on the Secretary's policies in rendering engineering services to another government pursuant to Section 411 of this Act."

FALL MEETING CITY CHANGED FROM NEW ORLEANS TO JACKSONVILLE

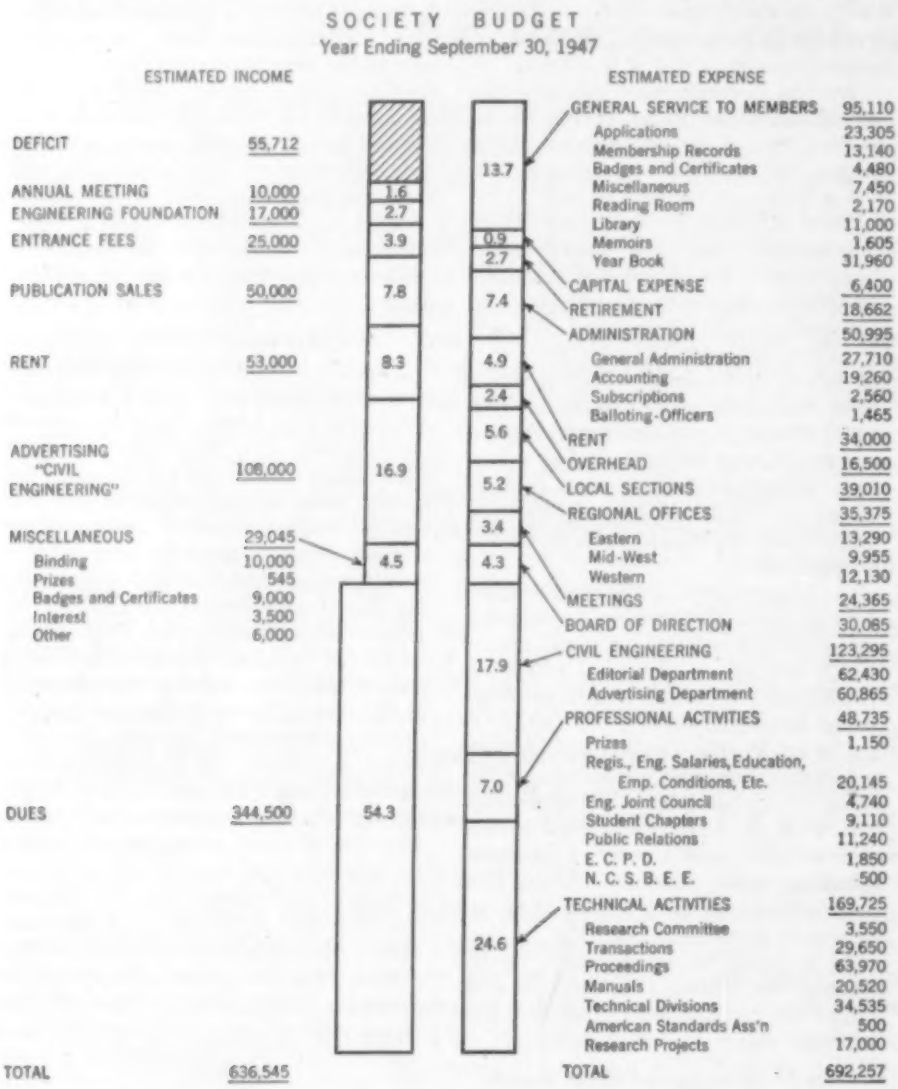
An unexpected hotel situation has made it necessary to abandon New Orleans as the location of the 1947 Fall Meeting of ASCE.

The Meetings Committee of the Board of Direction has decided to accept the invitation of the Florida Section to hold the Fall Meeting in Jacksonville, Fla. The dates are October 15, 16 and 17, 1947, and the headquarters will be the Roosevelt Hotel.

Members Study 1947 ASCE Budget

Details Perused in Connection with Proposed Increase in Dues

TOGETHER WITH SIGNED PETITIONS for bringing to ballot constitutional amendments on proposals to enfranchise Juniors and increase ASCE dues $5 per year for Corporate Members and Affiliates and $2.50 per year for Juniors (CIVIL ENGINEERING for March 1947, page 48). Society headquarters is receiving many requests for details of the deficit budget on which the Society is operating this year. The signed petitions received to date make it appear certain that more than enough signatures will be forthcoming to bring the proposed amendments to ballot following the summer Convention in July. Seventy-five signatures are required on each petition from each of the four zones of the Society.



The inquiries accompanying signed petitions indicate a healthy interest in the two proposals. They indicate also, however, that there are many misconceptions as to the size of the Society's operating budget, the scope of its activities, and the relationship between its technical and professional functions. Many inquirers express great surprise to learn that the Society's budget of expenditures for the current fiscal year, which ends September 30, 1947, is just under $700,000.

As shown in the accompanying diagram, the estimated expenses of the Society this year are $692,257, while income is estimated to be $636,545, with a resultant estimated deficit of $55,712. Income from dues, estimated at $344,500, will provide only 54.3 percent of the Society's total income. The Society's technical activities, in keeping with the original objectives of the organization, are responsible for the largest single item of expenditure, $169,725, while the professional activities, most of which were undertaken relatively recently, are estimated to cost $48,735.

Copies of the diagram, which it is hoped will be helpful to ASCE members in their considerations as to whether to increase Society dues or curtail activities, are available at Society headquarters upon request.

Bill Revalidating Licenses Is Introduced at Albany

SUPPORT IS BEING SOUGHT for a bill recently introduced in the New York State Legislature to correct an embarrassing situation caused by recent legal rulings declaring invalid certain long-standing and necessary provisions of the State Engineers' Registration Law. To correct this situation Senate Bill Int. 1414 has been introduced in the State Legislature by Senator Griffith. Provisions of the bill would accomplish three main objectives:

1. Revalidation of the 15-year clause permitting the licensing of eminently qualified engineers of long-established and recognized standing in the engineering profession, who have practiced lawfully for more than 15 years.

2. Revalidation of the interstate clause, permitting the licensing, without reexamination, of qualified engineers who are registered (by examination) in other states.

3. Revalidation of all licenses hitherto issued under the 15-year clause and the interstate clause (since January 1, 1937).

This bill, introduced at the request of the Joint Legislative Committee on the State Education System, is sponsored by the State Education Department and the State Board of Examiners of Professional Engineers. It also has the sponsorship and endorsement of the engineering profession, including the Metropolitan Section of ASCE, the New York State Joint Committee of Local Sections of ASCE, the New York State Society of Professional Engineers, and other engineering groups.

All interested individuals and organizations are urged to support the measure by writing to the New York State Senate Committee on Public Education, Albany, N.Y.

ASCE Secretary Carey Addresses Local Sections on Constitutional Amendments

CURRENT ISSUES OF vital importance to the Society and its Members were discussed before Local Sections by W. N. Carey, Executive Secretary of the ASCE, on a twelve-day trip through the South and Middle East. Increasing of professional activities, the Society's present financial status, and its need for increased dues to maintain present activities and increase its services to Members, were emphasized by Colonel Carey.

Two constitutional amendments, for which petitions are now in circulation—the proposed enfranchisement of Juniors and the recommendation that dues be increased—were covered in detail at each meeting. The interrelationship between these two issues was stressed by the Executive Secretary, who pointed out that the Junior segment of the membership of the Society constitutes just under one-third of the total membership. "This attraction of the younger engineer to the Society can be ascribed to the diversification of our program, and the broadening of our scope of activities to make the ASCE more than a purely honor society," he said.

Participation of the Society in such group organizations as Engineers Joint Council was also cited as an important step in the professional advancement of engineering. Already EJC has made itself effectively known in matters of both national and international importance, Colonel Carey stated. Indicative of the keen interest shown by the Society membership in the issues presented is the fact that the question-and-answer periods which followed the informal talk by the Executive Secretary were in every case much longer than the talk itself.

Colonel Carey's trip—made by automobile—covered 2,800 miles. Leaving New York on February 22, he attended a luncheon meeting of the North Carolina Section at North Carolina State College in Raleigh on February 24. ASCE Director W. M. Piatt was present, as were Section Secretary George Maurice of Eagle Springs, and several other out-of-town members. The attendance of 33 also included several Student Chapter members. Prof. R. E. Stiemke, vice-president of the Section, presided.

After the Raleigh meeting and 211 miles of fast travel to Columbia, S.C., the Executive Secretary attended a special dinner meeting of the South Carolina Section at the Jefferson Hotel in Columbia. Section President C. P. Roberts presided, and the Section Secretary, A. E. Johnson, and about 30 other members were present.

The next meeting was a special dinner meeting of the Florida Section, which was held at the Seminole Hotel in Jacksonville on the evening of February 26. The attendance of about 50 included President H. D. Van Vranken, who presided, and Secretary R. W. Cloues.

Another special dinner meeting was held with the Georgia Section at Atlanta on the evening of February 28. President Robert Harris was in the chair and Secretary M. R. Williams and about 65 other members were present.

A luncheon meeting with the Nashville Section at Nashville, Tenn., on March 2 came next on the Executive Secretary's itinerary. The attendance of about 40 included President D. C. A. du Plantier, the presiding officer, and Secretary James F. Sharp.

The Kentucky Section had arranged a special dinner meeting at Louisville on March 4. For this meeting, ASCE Director D. V. Terrell drove over to Louisville from Lexington. Also present were President S. M. Bailey, Secretary W. R. McIntosh, and 25 other members.

On March 5, Colonel Carey concluded his itinerary with a visit to the regular dinner meeting of the Cincinnati Section, which was held at the Cincinnati Engineers Club. The attendance of about 70 included a large number of Juniors, President L. J. Backman, and Secretary C. F. Renz. The meeting was conducted by Juniors.

Editorial Stresses Dues Increase Need

THE PROPOSED ASCE AMENDMENT to increase dues "merits the same careful unbiased consideration by every voting member that would be given to an important engineering decision encountered in line of duty," says the *Tennessee Valley Engineer*, monthly publication of the Tennessee Valley Section, ASCE, in a page-one, March-issue editorial.

"Such consideration can be trusted to lead to a correct decision in the best interests of the Society," the editorial states in commenting on the proposal to increase dues, by constitutional amendment, $5 per year for Corporate Members and Affiliates and $2.50 per year for Juniors.

Other excerpts from the editorial follow:

"Few among us would like to see our field offices closed, allocations to Local Sections reduced, or the volume of our publications reduced.

"These, however, are definite probabilities unless revenues are increased, for obviously deficit budgets such as that for the current year cannot continue.

"The increase is necessary if the American Society of Civil Engineers is to move ahead and continue to carry on activities that are desirable in the interests of the membership and the profession.

"A reduction in publications is unthinkable. The real need is for an increase in the volume of publications in order to publish the many papers now awaiting publication and to provide a medium for future papers."

E. L. Chandler Addresses Concrete Pipe Convention

GOVERNMENT AND INDUSTRY can, and must, work together if the country is to prosper, E. L. Chandler, Washington Representative of the ASCE, said in an address before the thirty-ninth annual convention of the American Concrete Pipe Association. Speaking on "Affairs in Washington Affecting the Construction Industry," Mr. Chandler emphasized the fact that there is opportunity for trade associations to be of real service in Washington, as well as to benefit the immediate interests of their members, and counseled the group to be alert to such opportunities for service.

Other ASCE members appearing on the three-day technical program included D. C. Greer, state highway engineer, Texas State Highway Department; Hal H. Hale, executive secretary, American Association of State Highway Officials; H. R. McBirney, chief of the Canal Engineering Division, U.S. Bureau of Reclamation; Kenneth Markwell, assistant commissioner, U.S. Bureau of Reclamation; and R. Robinson Rowe, senior bridge engineer, California State Department of Public Works.

The convention was held at the Hotel Statler, St. Louis, Mo., February 24 to 26.

Applications for Freeman Fellowship Are Due Soon

APPLICATIONS are about to close for the 1947 award of the Freeman Fund. With immediate attention on the part of any young engineer interested, there is still time for consideration of applicants before the closing date of May 31.

The committee in charge has in mind two particular outlets for the current award in the general field of hydraulics:

1. Grants toward expenses for experiments, observations, and compilations to discover new and accurate data that will be useful in engineering; and

2. A traveling scholarship, open to members younger than 45 years, in any

grade of membership, in recognition of achievement, or promise; and for the purpose of aiding the candidate to visit engineering works in the United States or any other part of the world where there is good prospect of obtaining information useful to engineers.

Other eligible items covered by the original grant of the late John R. Freeman, Hon. M. ASCE, included the writing, translating, or publishing of hydraulic material. These elements also are possibilities as a basis for the award.

As time is short, applicants are advised to correspond immediately with the Chairman of the Freeman Fund Committee, Malcolm Pirnie, 25 West 43rd Street, New York 18, N.Y., giving general details as to the work contemplated. Decision as to the winner of this award is expected to be made in time for beginning work during the summer or by the start of the fall college year, at the latest.

Follow-up Session on Highway Safety Planned

BECAUSE OF THE SUCCESS of the 1946 President's Conference on Highway Safety, the "Action Program" group will be reconvened in 1947, on June 18, 19, and 20. In charge of arrangements for this session will be Maj. Gen. Philip B. Fleming, M.ASCE, Federal Works Administrator, who served as chairman of the 1946 conference. As one of the national organizations participating in the 1946 conference, ASCE will be represented at the June session. This year, as last year, its representatives will be Col. William N. Carey, Executive Secretary, and W. W. Horner, Past-President.

Governor Millard F. Caldwell of Florida, who is president of the U.S. Conference of Governors, has been invited to serve as vice-chairman of the June session and is expected to accept. Public Roads Commissioner Thomas H. MacDonald, Hon. M.ASCE, will continue in his position as chairman of the Coordinating Committee of the Conference.

The National Safety Council estimates that there were 33,500 traffic fatalities in 1946 for a death rate of 9.7 persons per 100 million vehicle miles. That compares with rates of 11.3 in 1945 and of 12 in 1941. Had the 1941 rate prevailed in 1946, the death toll would have been 6,500 higher. In addition to 48 governors and their state representatives invited to attend the Conference, the presidents of national organizations that participated in the 1946 conference, members of the Coordinating Committee, and chairmen of the eight major working committees will also be present. A total of 200 persons is expected to attend.

ASCE Suggests Reclamation Bureau Improvements to Secretary of Interior

CONSTRUCTIVE SUGGESTIONS in the best interest of the public, the Bureau of Reclamation, and the engineering profession have been made to J. A. Krug, Secretary of the Interior, by a committee appointed for that purpose by the ASCE Board of Direction. At a recent conference in his office, Secretary Krug, in taking the suggestions under advisement, assured the ASCE committee that he has no substantial divergence of view regarding the fundamental objectives and policies recommended by the committee.

The matters discussed with Secretary Krug were brought to his attention shortly after the April 1946 meeting of the Board of Direction. Appointments for conferences were made but Secretary Krug found it necessary to cancel them because of continuing pressure of other duties. The matters for discussion were outlined in resolutions of the Board which authorized and directed the President to arrange a conference for discussion of the general policies contained in the resolutions. The Board and the committee deemed it inappropriate to give publicity to their views prior to understandings anticipated to result from the requested conference.

Recognizing the Bureau of Reclamation to be a government engineering organization essential to the public welfare and a substantial contributor to the prestige of the engineering profession, the Board of Direction considered it to be its duty to offer constructive suggestions directed to continuance of the Bureau's excellent record in the field of reclamation since its creation near the beginning of the present century. The engineering profession is justly proud of this record and the Board of Direction of ASCE feels that it is privileged to offer criticism or commendation of Bureau activities at any time.

Several of the questions raised in the April discussions of the Board of Direction already had been answered satisfactorily by Secretary Krug in his statement of policy made public May 31, 1946. The committee suggested a few minor changes be made in the statement for the purpose of clarifying the intent, and the Secretary stated he would welcome written recommendations on rewording.

It was the understanding of the committee that it is the intent of Secretary Krug to effectuate procedures suggested by the committee, in that: (1) The Bureau of Reclamation would continue to devote its activities to those engineering services needed for development of the water resources of the seventeen reclamation states of the West in accordance with authorizations to the Bureau under specific acts of the Congress; and (2) requests for technological services received by the Government of the United States from other nations would be referred, under appropriate regulations, to properly qualified individuals or organizations not necessarily a part of government in order that all properly qualified technologists in the country may be considered in the selection of the best available persons to furnish engineering services needed to solve engineering problems in other countries.

The committee presented additional suggestions for discussion including recommendations that: (1) The services of Boards of Engineering Consultants be more generally used in the investigational and in the project planning phases of the Bureau's work to insure that the best solution of the particular problem is reached, to reduce the cost of investigations and project planning and to improve the relations of the Bureau with the public; (2) the services of engineering organizations in private practice be used when feasible during expanding Bureau activities to avoid need for substantial increases in permanent staff when need for such expansion is likely to be of temporary duration; (3) the offices of Commissioner and Assistant Commissioner of Reclamation should, when possible, be filled by qualified engineers of administrative ability who are familiar with the water problems of the West; and (4) publicity of potential projects under Bureau investigation should be avoided until the investigations have progressed sufficiently to define the various features of the project and to permit reasonably accurate estimate of the cost thereof and the probable benefits.

Secretary Krug, in conclusion, again referred to his policy statement of May 31, 1946. He expressed the hope that in the future situations would not arise in connection with the policies and work of the Bureau of Reclamation to which the members of ASCE could take proper exception. He requested, if such situations should arise, that the Society bring them to his attention. The committee will request the Board of Direction to make provision for compliance with this suggestion by the Secretary.

The committee was composed of W. W. Horner of St. Louis, Past-President, ASCE, as chairman; E. M. Hastings of Richmond, President, ASCE; Malcolm Pirnie of New York, Past-President, ASCE; R. J. Tipton of Denver; W. M. Carey, New York, Executive Secretary of ASCE; and E. L. Chandler, Washington, D.C., Eastern Representative of ASCE. Although the conference lasted nearly an hour and a half, a strong spirit of mutual understanding and willingness to cooperate prevailed throughout.

Speaker's Club Is Stepping-Stone to Sacramento Section Presidency

FRED PAGET, ASSOC. M. ASCE

Past-President, Sacramento Speakers' Club

ALTHOUGH ONLY a six-year-old organization, the Sacramento Section Speakers' Club has a record worthy of an old-time institution. Since 1941 the club has metamorphosed over a hundred engineers. Once acute sufferers from stage nervousness and mike fright, they now accept invitations to speak with all the zest and eagerness of a G.I. hurrying home for a five-day furlough.

In monthly meetings, the present 32 active members, engineers all, revel in the criticism and professional prompting of their public speaking professor. Under his tuition and the stimulus of a common cause, they have been surprised to learn how easy it is to turn a dry, boresome, intricate engineering presentation, followed by few and endured by many, into an interesting, entertaining talk, understood by most and enjoyed by all.

Emphasis is on engineering, but everything is grist for the mill. At a so-called "brag session" during the prelude to their meeting, members report talks they have given to outside organizations. Although engineering topics predominate, it is revealed that every once in a while some luncheon club or other civic gathering listens to a talk on literature, art, travel, science, or other current topic, given by an engineer.

From time to time throughout the year, an individual member of the Speakers' Club appears as the noonday speaker at the weekly luncheon meeting of the Sacramento Section. In addition one Section meeting each year is reserved so that club members may demonstrate their speaking ability. These annual programs, produced and put on by the club with several members taking part, have ranged all the way from the pros and cons of controversial engineering projects to post mortems of the past and fantasies of the future.

The members of the Speakers' Club were proud in 1943 when the president of the Sacramento Section was chosen from among them. This year they are happy that it has happened again. They hope it becomes a habit.

Head coach, critic, and mentor is Mason A. Johnston, of the Sacramento College. Officers of the club for 1947 are: Francis G. Christian, president; William Popper, first vice-president; Stewart Mitchell, second vice-president; and George W. Smith, secretary-treasurer.

The club is operating along the same lines as when it was organized in 1941. For a news item covering its organization, reference is made to the October 1941 issue of CIVIL ENGINEERING, page 626.

EJC Issues Preliminary Report in Survey of Employer Practices

"A WELL-ROUNDED-OUT INDIVIDUALITY with a good personality, qualified by education and experience, will make a good engineer."

That, it would seem is what employers seek in engineering college graduates when they interview them as prospective employees, according to a report on a preliminary survey of employer practice regarding engineering graduates which has just been made public by a subcommittee of Engineers Joint Council.

The object of the survey is to learn directly from a representative group of industrial employers their attitudes and policies regarding selection, training, placement, advancement, guidance and professional activities of engineering graduate employees. The results recently made public by the committee are of a preliminary character and are based on questionnaires sent to 174 employers of engineers, from whom 104 replies were received. The replies came from 19 fields of industry and were from employers in both large and small concerns which employ some 40,000 engineers among a total approximating 2,000,000 employees.

The subcommittee, which is planning a more complete questionnaire to be circulated later to a larger and more representative list of employers, is one of three subcommittees of the EJC Committee on the Economic Status of the Engineer. Of the other two, one is engaged in compiling a report on a recent survey of the engineering profession as a whole, and the other has ready for publication shortly the first section of a comprehensive manual covering labor laws and regulations as they concern engineers in professional work. Each of these three subcommittees is composed of representatives appointed by: American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Institute of Chemical Engineers, and National Society of Professional Engineers.

The following are among the general observations of the employer practice subcommittee, based on the questionnaires returned in the preliminary survey:

Ninety-six percent of cooperators employ cadet engineers directly upon graduation, but only 4 percent recruit engineering staffs exclusively from new graduates. About 43 percent engage more than half of their new engineer employees after they have had one or more years' experience with other employers. Apparently this is a matter of necessity or expediency, rather than preference, because more than 60 percent of those reporting indicate that they prefer to employ the new graduate.

Seventy percent send representatives to engineering schools to interview students individually. Nearly all of these discuss the candidates with members of the college faculties, in addition to interviewing the students.

Only 25 percent of those reporting do not differentiate between engineers and other employees in the process of hiring. Only two companies report that engineers are employed without meeting at least one executive engineer. From a statistical analysis of the replies, weighting the first, second and lower choices in the way that preferential ballots are usually counted, the considerations which carry the most weight in selecting a candidate for an engineering position, in the order of their importance, are as follows:

1. Personality
2, 3. Scholastic record
Indicated promise of development in specific field of engineering
4. Engineering experience
5. Evidence of ability to cooperate with others
6. Recommendations by qualified people
7. Indicated promise for executive development
8. Standing of college from which candidate was graduated
9. Salary requested

This and the final survey by this committee are being made by Engineers Joint Council in an effort to develop facts sought by younger engineers from the national engineering societies. The preliminary survey contains much additional information of interest and value to the younger engineer. Reprints of the preliminary report are available at ASCE headquarters upon request.

AASHO Committee on Salaries Makes Interim Report on 1946 Salaries for Highway Engineers

AN IMPORTANT INTERIM REPORT of the Committee on Salaries, American Association of State Highway Officials, released late in 1946, tabulates the salary ranges paid to engineering employees of 48 state highway departments. It discloses large variation between salaries for positions bearing the same title in different states as well as a vast difference in overall salaries in different states. Even in the ten states which receive the largest amount of federal-aid funds, wide differences can hardly be explained by the difference in living conditions, or differences in efficiency of engineering personnel. It is apparent that titles do not mean the same thing in all states.

After consultation with the Highway Research Board's Committee on Organization, which is currently studying types of organizations and job evaluation methods, it was decided to publish an interim report at this time, and to await the availability of those studies before completing a final report. "If something is not done immediately to hold the engineers we have and attract new ones, it will be necessary to curtail the contracting of additional work, and a drastic slowing down of our postwar construction will follow."

For the interim report, a tentative evaluation was made of state highway engineering positions, allocating them to engineering groups approximately equivalent to grades in the federal professional series (which are substantially the same as the ASCE 1946 recommended grades). From the committee's data it is possible to show, in Table I, the median salary ranges corresponding to these grades in the highway departments of New York, Texas, Pennsylvania, Illinois ,California, Ohio, Michigan, Missouri, Minnesota, and Indiana. For comparison, current federal rates and ASCE 1946 recommended rates are shown in the same table.

Space does not permit tabulating here the entire range of salaries for various positions in all states. Since the salaries for rank-and-file positions are necessarily influenced by the rates paid for the highest position in each organization, it is significant to note that the ranges reported for "Chief Administrator" or "Highway Commissioner" in the 48 states are between $3,600 (Idaho), $4,000 (Iowa and Texas), and $10 per day) evidently part-time service, in Missouri, Montana, and New Mexico); and $12,000 (California, New York, and Pennsylvania), $12,500 (Virginia), and $15,000 (New Jersey). The ranges for "Chief Engineer" are between $14,500 (maximum for Utah), $4,800 (Arkansas, Georgia, and Idaho), $5,000 (Kentucky, North Dakota, and Ohio); and $12,000 (maximum for Pennsylvania), $12,240 (California), and $15,000 (New Jersey). Some of the differences at these top levels undoubtedly reflect degrees of responsibility, depending on the respective organization charts.

With the report is presented a proposed classification of highway employees' titles (positions) into nine groups. These specifications list activities and minimum requirements. The groups correspond approximately to federal professional classes bearing the same numbers.

The complete report in mimeographed form was received from the general offices of AASHO at 1220 National Press Building, Washington 4, D.C. It was published, except for the tabulation by individual titles for each state, in *American Highways* for January 1947.

The AASHO committee consisted of D. C. Greer, M. ASCE, Texas, chairman; Fred R. White, M. ASCE, Iowa; William J. Cox, M. ASCE, Connecticut; Thomas E. Stanton, M. ASCE, California; C. E. Vogelgesang, M. ASCE, Indiana; C. D. Curtiss, M. ASCE, Public Roads Admin.; W. Vance Baise, North Carolina; R. M. Reindollar, M. ASCE, Maryland; and R. A. Allen, Nevada.

TABLE I. SALARY RATES IN TEN STATE HIGHWAY DEPARTMENTS
Compared with Current Federal Rates and ASCE 1946 Recommendations

Median Rates from AASHO Report on 10 States with Largest Federal Aid		Current Federal Rates			Current Recommendations of ASCE		
			Range			Range	
Group	Range of Medians	Grade	Min.	Max.	Grade	Min.	Max.
1	$1,500–1,890	P-1	$2,645–	3,400	I	$2,700–	3,400
2	1,950–2,790	P-2	3,400–	4,150	II	3,400–	4,200
3	2,059–2,965	P-3	4,150–	4,902	III	4,200–	5,100
4	2,575–3,760	P-4	4,902–	5,905	IV	5,100–	6,100
5	3,000–4,576	P-5	5,905–	6,863	V	6,100–	7,250
6	3,986–5,115	P-6	7,102–	8,060	VI	7,250–	8,600
7	4,656–6,612	P-7	8,180–	9,376	VII	8,600–	10,350
8	8,400–9,450	P-8	9,975–	10,000	VIII	10,350–	12,600
		P-9	10,000 and up		XI	12,600 and up	

Panama Discussions Are to Be Unified

SINCE THE PRINTING of two papers on the Panama Canal in the February 1947 PROCEEDINGS, a plan has been approved by the Society's Publications Committee for enlarging and simplifying the whole treatment of this subject. One immediate result will be to defer the printing of discussions. Their submission is meanwhile encouraged, particularly while the interest in these subjects is high, even though the actual appearance of the discussions in print may be delayed.

These two papers by Messrs. DuVal and Claybourn have been "in the works" for some months, even years. Meanwhile a Congressional directive has started an intensive official study of the whole broad Panama Canal development. An eminent engineering consulting board, as reported in the October 1946 CIVIL ENGINEERING, in addition to the regular Panama Canal staff, has been busy on this work under direction of the Governor General J. C. Mehaffey. Out of it are expected to come a number of technical papers of special interest to civil engineers. These, however, cannot be released until the report itself is submitted to Congress toward the end of the year.

The Society is therefore cooperating in arranging for a broad symposium on the Panama problem at its January 1948 meeting, covering plans additional to the present Society papers. Because these new papers are thus restricted for a short time, the Publications Committee has concluded that discussion of the overall subject would be more enlightening and productive if all printed discussion were deferred until such time as it can encompass the expected as well as the presently available papers.

If for any reason the engineering report of Governor Mehaffey to Congress is delayed beyond December 31, 1947, it is the intent of the Committee on Publications to release forthwith any waiting material on the Panama problem, including all discussions that may be available on the present DuVal and Claybourn papers. It is hoped, however, that by holding over the intervening discussions, printed comments on the proposed symposium as well as on the present papers may come out concurrently after January 1, 1948.

Miami Section Selects Union Station Site

EFFORTS OF THE Miami Section to aid in the selection of a site for a proposed union railroad station in Miami have been widely headlined in Miami papers.

Sometime ago, at the request of local authorities, the Section appointed a committee to consider the future railroad needs of the city and make specific recommendations for a site for the proposed union station.

The committee first made a careful analysis of population trends, and final selection of an area between N. W. 36th Street and N. W. 54th Street was based on its being the theoretical center of Miami's indicated future population. Other determining factors were that the proposed site is near the 36th Street airport, facilitating exchange of passengers between the two types of carriers; that only a small amount of track would be needed to connect with the Miami–Okeechobee branch of the Florida East Coast Railway; and that traffic congestion caused by railroad car switching in downtown Miami would be ameliorated.

The committee's plan, which has been unanimously endorsed by the Section, calls for a large area, with parks adjacent to the station and parking facilities in close proximity. A Spanish, or Mediterranean, type of architecture is recommended for the structure itself.

Juniors Given Voice in Annual Meeting Plans

FOR THE FIRST TIME a Junior is serving on the Annual Meeting Committee of the Society's Metropolitan Section in New York. At its February 28 meeting, this committee took action to make the president of the Junior Branch of the Metropolitan Section a member of the committee.

Thus every man elected president of the Junior Branch will automatically become a member of the committee on arrangements for the Annual Meeting for the period of his term in office—that is, one year.

The action will facilitate participation of Juniors in the planning of the Society's Annual Meetings.

Registration Bill Is Introduced by Shannon

AN ENGINEER'S LICENSE BILL, following closely the pattern established by the Model Registration Law which ASCE has helped draft and promulgate in various states, has been introduced in the Washington State Legislature by ASCE Vice-President William D. Shannon.

Representing the forty-third district in Seattle, his home city, Mr. Shannon introduced the legislation early in the current session of the legislature, to which he was elected last fall.

From his Washington House of Representatives letterhead, it is pleasing to note that the legislature has assigned Mr. Shannon to committees on which the talents of an engineer would be most beneficial. He has been made chairman of the legislative body's public utilities committee, and a member of the appropriations, reclamation and irrigation, forestry, state lands and buildings, and cities and counties committees.

Society Appointments

H. ALDEN FOSTER AND ERNEST P. GOODRICH, Members ASCE, have been appointed ASCE representatives on the Engineering Societies Monographs Committee, succeeding L. J. BEVAN and GEORGE W. BOOTH, Members ASCE, whose terms have expired.

THORNDIKE SAVILLE, M. ASCE, has been appointed to succeed the late Glenn H. Parker, M. ASCE, as ASCE representative on the American Association for the Advancement of Science.

NEWS OF LOCAL SECTIONS

Coming Events

Alabama—All-day meeting at the Thomas Jefferson Hotel, Birmingham, April 25. Dinner in the evening.

Central Ohio—Dinner meeting at the Chittenden Hotel, Columbus, April 17, at 6:15 p.m. Speaker will be Murray D. Schaeffer, state highway director.

Cincinnati—Dinner meeting in the Engineering Society Building, Cincinnati, April 2, at 6:30 p.m.

Connecticut—Dinner meeting at the Faculty Club, 149 Elm Street, New Haven, Conn., April 9, at 6:30 p.m. Speaker will be W. J. Cox, state highway commissioner.

Kansas City—Dinner meeting in the Pine Room of the Union Station, Kansas City, Mo., April 22, at 6:30 p.m. Speaker will be H. E. Hilts, deputy commissioner, P.R.A.

Los Angeles—Dinner meeting at the Los Angeles Athletic Club, Los Angeles, April 29, at 6:30 p.m. Program will start at 8 p.m. Speakers will be ASCE President E. M. Hastings and Executive Secretary W. N. Carey.

Maryland—Meeting at the Engineers Club, Baltimore, April 23, at 8 p.m. Meeting preceded by cocktails at 6 p.m., and dinner at 7 p.m.

Metropolitan—Meeting in the Engineering Societies Building, New York, April 16, at 8 p.m.

Michigan—Dinner meeting in the Engineering Societies of Detroit Building, Detroit, Mich., April 25, at 6:30 p.m. Speaker will be Paul Van Buskirk, location engineer, Huron-Clinton Metropolitan Authority.

Mid-South—Spring meeting at Little Rock, Ark., April 25. All-day meeting, with two technical sessions.

North Carolina—Spring meeting at Durham, N.C., May 2.

Northeastern—Joint meeting with Boston Society of Civil Engineers at Northeastern University, Boston, April 16, at 6 p.m.

Northwestern—Dinner meeting at the Campus Club, University of Minnesota, April 7, at 6:30 p.m. Speaker will be Carl Menzel, of the Portland Cement Association Research Laboratory.

Philadelphia—Dinner meeting at the Engineers Club, Philadelphia, April 8, at 6 p.m. Program starts at 7:30 p.m. Speaker will be Charles M. Noble, New Jersey state highway engineer.

Sacramento—Regular luncheon meetings at the Elks Club, Sacramento, every Tuesday at 12 noon.

Tennessee Valley—Spring meeting at Gatlinburg, Tenn., April 11 and 12. Registration at the New Gatlinburg Inn., April 11, at 10 a.m.

Texas—Luncheon meeting of the Dallas Branch at the Adolphus Hotel, Dallas, May 5, at 12:15 p.m.; luncheon meeting of the Fort Worth Branch at the Blackstone Hotel, Fort Worth, April 7, at 12:15 p.m. Speaker will be Harold S. Foster, industrial manager, Fort Worth Chamber of Commerce.

Tri-City—Dinner meeting at the Blackhawk Hotel, Davenport, Iowa, April 10, at 6:30 p.m.

Wisconsin—Meeting in the Hydraulics Laboratory, University of Wisconsin, Madison, Wis., April 24, at 7:30 p.m.

Scheduled ASCE Meetings

SPRING MEETING
Phoenix Ariz., April 23–26
(Board of Direction meets April 20–22)
SUMMER CONVENTION,
Duluth, Minn., July 16–19
(Board of Direction meets July 14–15)
FALL MEETING
Jacksonville, Fla., October 15–17
(Board of Direction meets October 13–14)

Recent Activities

ARIZONA

MEMBERS OF THE Arizona Section went to Yuma, Ariz., on February 20 for a joint dinner meeting with the Yuma Engineers Club. Discussion of tests on fixed military bridges comprised the technical program, the speakers being Norman G. Hansen and Robert G. Jacoby. Both are with the Yuma Test Branch of the Army Engineer Board. George Howard, president of the Yuma Engineers Club, presided.

CENTRAL OHIO

THE NATION, AS a whole, is wasteful in the disposal of its refuse, Alden E. Stilson, Columbus consultant, told the members of the Section at their February dinner meeting. Speaking on "Refuse Solids Disposal in Municipalities," Mr. Stilson stated that two of the most widely used methods are land fill and incineration. As chief sanitary officer for the Tenth Army, during the war, Mr. Stilson was in charge of constructing a water system on Okinawa. During the meeting, the Section went on record as endorsing the proposed bill to create a Division of Maps and Mapping in the Ohio Department of Public Works.

COLORADO

USE OF AIR-ENTRAINING concrete is one of the most important developments in pavement construction in recent years, according to Warner Harwood, regional highway engineer for the Portland Cement Association at Chicago. In a talk on "Developments in Concrete Pavement Construction," given at the February 10 dinner meeting, Mr. Harwood pointed out that it is now generally believed that expansion joints are seldom needed, provided intermediate contraction joints are built at frequent intervals to eliminate cracking. Some states have constructed concrete pavements with expansion joints as much as one mile apart, but with contraction joints placed at 50- and 60-ft intervals, he said. Citing progress in studies of pumping in concrete pavements, the speaker stated that many miles of such pavements have been restored by pressure pumping of suitable material under them. Soil studies, however, are necessary to determine the feasibility of this procedure.

DAYTON

USE OF THE Intrusion Prepakt method of repairing and rebuilding stone masonry and concrete structures was described at the February luncheon meeting by B. D. Keatts, regional vice-president of Intrusion Prepakt, Inc., of Cleveland, Ohio. The method consists of removing all loose or damaged concrete or mortar, and rebuilding the structure to its original strength. The areas to be built up are packed with gravel aggregate, through which a cement grout is forced under pressure by means of 1-in. steel pipes thrust to the bottom of the aggregate. The finished product, Mr. Keatts said, will withstand pressures of 4,500 to 5,000 psi. The speaker showed slides of various repair jobs, including the Boulder Dam diversion tunnel. Scouring at the bottom of the tunnel had gouged out a section 50 ft deep, and 16,000 cu yd of concrete was required to restore the tunnel to its original condition.

FLORIDA

A NUMBER OF Student Chapter members swelled the attendance at a joint meeting of the Section and the University of Florida Student Chapter, which took place on the university campus in Gainesville on March 1. The afternoon was devoted to inspection of the university's aeronautics hangar, electronics and other research laboratories, and machine shops. Professors in charge of each department explained the objectives of their experiments. One of the featured speakers at the banquet that followed the inspection trips was Prof. H. Hansen, of the university's civil engineering department, who described "Florida Beach Erosion Problems." His discussion was amplified by Robert M. Angas, of Jacksonville, who described personal observations made during surveys of beach areas. Joint presiding officers were H. D. VanVranken, president of the Section, and Tom Allerdice, Student Chapter president.

A special dinner meeting was called on March 5 for the purpose of conferring with Carl E. Beam, assistant to the Executive Secretary of the ASCE, concerning the possibility of holding the Fall Meeting of the Society in Jacksonville.

GEORGIA

PROBLEMS THE YOUNG engineer may expect to encounter in launching a private practice and assuming the status of an engineer employer were discussed by Walter McDonald, past-president of the Section, on March 7. Speaking at the regular monthly dinner meeting, which was held at the Georgia School of Technology, Mr. McDonald addressed his remarks particularly to the Student Chapter members present. He based his talk on his experiences as an engineer-architect in the Atlanta area.

HAWAII

TO ENCOURAGE THE WRITING OF technical papers on subjects related directly to the Hawaiian Islands, the Section has established a Hawaii Technical Papers Award for the best paper or papers on such subjects to be published, during the 1947 calendar year, in CIVIL ENGINEERING or PROCEEDINGS. The amount of the award may not exceed $100 for any one paper or $150, in any proportion considered suitable, for two papers, the decision to rest with the award committee of three members. Speakers at recent meetings have included Col. B. I. Robinson, U.S. District Engineer for the Hawaii District, who discussed his wartime experiences on the staff of the Engineer for General MacArthur; and Robert H. Lloyd, planning and designing engineer for the Hawaiian Pineapple Co., Ltd., who described water development on the Island of Lanai. Officers for 1947 are Joseph Kunesh, president; Ben E. Nutter, vice-president; Knute Vaksnik secretary; and George E. Hatch, treasurer.

INDIANA

"IT IS THE sincere hope of the officers and Directors of your Society that the decisions of all of the Boards of Direction which, in the past quarter century, have initiated our broadened program of activities, truly represent the desire of the membership for a truly professional Society, and that our course in the future will be a continuation of our present progressive program," ASCE Vice-President Ralph B. Wiley told the members at a recent dinner meeting. Professor Wiley made a strong appeal for favorable consideration of the proposed constitutional amendments, pointing out that dues must be increased if the Society is to expand its activities in the field of service to the members and still maintain its currently high plane of technical activities. ASCE Director Daniel V. Terrell and George S. Salter, Mid-West Representative of the Society, were also present and spoke briefly on other phases of current Society activity.

INTERMOUNTAIN

A 15-MINUTE REVIEW of articles on professional activities of the ASCE, in the February issue of CIVIL ENGINEERING, was given by John S. Duder, a Junior in the Section, at the February dinner meeting. Mr. Duder's résumé, which covered President Hastings' inaugural address and a number of items in "Society News," was so well received that it was decided to have similar reviews of CIVIL ENGINEERING presented at each meeting by a different Junior. Another feature of the occasion was a talk by Walter E. Jessup, Western Representative of the ASCE, who discussed the proposed changes in the Constitution, recent professional activities, and the present financial status of the Society. Presentation of four student papers—under the direction of Harold S. Carter, professor of civil engineering at Utah State Agricultural College—concluded the program. The students were Harold Blaser and Ellof A. Olofson, of Utah State Agricultural College, and Thomas Begley and Warren Curtis, of the University of Utah.

IOWA

"COOPERATIVE ACTION OF Engineering

Organizations" was the topic of discussion at a recent joint meeting with Iowa sections of the Founder Societies. Speaker for the ASME was Prof. Henry Black; for the AIEE, Prof. W. L. Cassell; and for the Iowa Section, Prof. J. S. Dodds. ASCE Vice-President Ralph B. Wiley, head of the civil engineering school at Purdue University, also spoke on the subject, commenting particularly on the cooperative activities of Engineers Joint Council. Later Professor Wiley addressed a special meeting of the Section on current Society issues now under consideration by the Board of Direction and discussed the proposed constitutional amendments.

On March 5, the Section held a joint meeting with the Iowa State College Student Chapter at Ames. The technical program for the occasion consisted of a talk by Seth Winslow, of McKinsey, Kearney & Co., industrial engineers of Chicago, on the work being done by that firm.

ITHACA

GUESTS OF HONOR at a recent dinner meeting included ASCE Vice-President Arthur W. Harrington; Harland C. Woods, newly elected ASCE Director for District 3; and James E. Jagger, Assistant Secretary ASCE. Following a talk by Mr. Jagger on "Society Operation and Expansion," there was a general discussion of Society activities and the proposed constitutional amendments, for which petitions are in circulation. At another meeting—a joint session with the Cornell University Student Chapter on February 26—proposed amendments to the State Education Law and the Wagner Act were discussed. A talk on the Tennessee Valley Authority—by David Donley, associate professor of hydraulic engineering at Cornell University—concluded the program.

KANSAS

PROPOSED IMPROVEMENTS TO the Topeka, Kans., water plant were described by Frank Willey, engineer on the staff of the plant, at the February dinner meeting. During the evening Prof. C. H. Scholer, of Kansas State College, stated that the House Committee of the state Legislature voted unanimously in favor of a bill providing for the compulsory licensing of engineers in Kansas and that the bill would soon go before the House. Professor Scholer is chairman of a committee of three, appointed by Kansas engineers to draft the proposed compulsory licensing bill.

LOS ANGELES

THERE WAS a turnout of over 200 for the February meeting, which was devoted to a symposium on "Smog." Speakers for the evening included William M. Jeffers, who heads the *Los Angeles Times* Smog Advisory Committee; Harold W. Kennedy, county counsel for Los Angeles County; Roland W. Reynolds, engineer investigator of the Office of Air Pollution Control, Los Angeles County; and Howell Barnes, of the Los Angeles Chamber of Commerce Smoke and Fumes Committee.

The feature of the regular February meeting of the Junior Forum, held prior to the Section meeting, was a competition between Student Chapter representatives of the University of Southern California and the California Institute of Technology to select a representative for the Section for the student paper competition at the Phoenix Meeting. Irving L. Sulmeyer, of the California Institute of Technology, was the winner, and a check for $25 was presented to him as a prize from the Section.

MARYLAND

NOWHERE IS THERE greater need for housing of all types than in Baltimore, according to E. Lester Muller, Maryland state director of the Federal Housing Administration. Addressing the Section's February dinner meeting on the planning, construction, and financing of future housing projects in the area, Mr. Muller stated that the rapid industrial growth, which the city is expected to undergo in the immediate future, makes the construction of new housing imperative. With rapidly rising costs, he said, many veterans are finding it impossible to purchase homes and must look to renting, especially in multi-family units. In conclusion, the speaker emphasized the need for cooperation between the city, the Federal Housing Administration, and owners in connection with the development of housing groups.

METROPOLITAN

SPEAKING ON "Structural Applications of Aluminum," at the March 19 meeting, B. F. Fletcher, chief engineer of the development division of the Aluminum Co. of America, New Kensington, Pa., stated that aluminum will not replace steel as a structural material. Rather, he said, it will be used for specific purposes, where its light weight and resistance to corrosion will reduce maintenance over a period of years. During the evening, petitions for increase in ASCE dues and the right for Juniors to vote were circulated among the 400 members present.

The Society in its relationship to the Junior was discussed by William N. Carey, Executive Secretary ASCE, at the March 12 meeting of the Junior Branch. A spirited discussion followed Colonel Carey's presentation of facts and figures about the activities of the Society and the role of the Junior in those activities. Early questions of the "What does the Society do for me type?" developed, in the course of the discussion, into the "How can I make better use of my membership?" type of question. The Juniors were unanimous in agreeing that rather than sacrifice any new activities, the Society should raise dues.

MIAMI

MEMBERS OF THE Section, the Professional Engineers Association of Southeast Florida, and the Florida Engineering Society recently enjoyed an inspection trip to the plant of the U.S. Sugar Corp. at Clewiston, Fla. About 70 made the trip. Another recent meeting was devoted to discussion of a proposed union railroad passenger station for Miami. M. B. Garris, chairman of a Section committee to consider possible sites for the union station, presented his report, which was unanimously adopted by the Section. Guests participating in the discussion included G. Kirby, president of the Northeast Improvement Association of Miami, and Louis Schilling, president of the Junior Chamber of Commerce.

MICHIGAN

DETROIT'S PRESSING DOWNTOWN traffic problem will be alleviated if the proposed John C. Lodge Expressway is built, members of the Section were told at a recent meeting devoted to the topic of the expressway. First, progress in the development of expressways for Detroit was outlined by H. A. Shuptrine, engineer of bridges and structures for the Wayne County Board of Road Commissioners. Speaking on the same program, Julian C. Mead, engineer of structural design for the Board, gave a detailed account of studies, surveys, and designs in connection with the project. The February meeting was held jointly with the University of Michigan Student Chapter at Ann Arbor. ASCE Director L. W. Gram was present and reported on the 94th Annual Meeting of the Society in New York. Professor Gram emphasized the necessity of increasing annual dues, if the Society is to continue serving the membership as fully as possible.

MONTANA

LABOR UNIONS ARE making an effort to unionize engineers in the state, John H. Morrison warned members at a recent meeting. Leading a discussion on labor union organizational activities in Helena, Mr. Morrison stated that the unions believe there is a field for them, especially among engineering employees of the various state departments. Mr. Morrison—one of the directors of "Montana Civil Engineers," a group that is actively promoting a bill for registration of civil engineers in the present legislative session—also outlined the provisions of the proposed registration act and ex-

plained the status of the bill in the Legislature. Certificates of life membership have been awarded to Wilbur S. Hanna and H. W. Holmes.

NEW MEXICO

THERE WAS A large turnout, including more than 50 engineering students, at a recent meeting held on the campus of the University of New Mexico in Albuquerque. Student Chapter problems were discussed, and the Section decided to allot $100 to each Student Chapter in the state to help defray the cost of attendance at the Student Chapter Conference in Phoenix. A talk on ground water, by C. V. Theis, comprised the technical program for the occasion. At the conclusion of the meeting, members of the Student Chapter served refreshments.

NORTHWESTERN

THE ORGANIZATION OF the Corps of Engineers and its activities along both military and civil engineering lines were described by Col. Walter K. Wilson, district engineer for the Corps of Engineers at St. Paul, at the regular March dinner meeting. Colonel Wheeler discussed in special detail the engineering projects now being handled by the St. Paul office.

PHILADELPHIA

WARTIME EXPERIENCES GAINED in the operation of pontoon dredges and the employment of private contractors may speed up the state of Pennsylvania's program to clean the Schuylkill River, according to Frederick H. Dechant, Philadelphia consultant. Addressing the March 11 dinner meeting of the Section, Mr. Dechant said that the state will dredge the river of coal culm deposits by using dredging machinery similar to the floating drydocks employed during the war. Other speakers were Col. F. F. Frech, district engineer for the Corps of Engineers at Philadelphia, who explained federal interest in the project; Evan Evans, vice-president of the Lehigh Navigation Coal Co., who described what has been done by his company toward abatement of pollution; and James H. Allen, executive director of the Interstate Commerce Commission on the Delaware River Basin, who presided. Mr. Allen predicted that by 1951, when a four-state $100,000,000 stream-clearance program will be completed, the Schuylkill and Delaware rivers will be well along the way to freedom from pollution. He called the project "the most intensive stream-clearance program ever to be undertaken in any river system."

PITTSBURGH

CIVIL ENGINEERING ASPECTS of the transportation industry were discussed by D. L. Sommerville, chief engineer of the Central Region of the Pennsylvania Railroad, at a recent joint meeting with the Pittsburgh section of the Engineer's Society of Western Pennsylvania. Showing of a colored film, "Clear Track Ahead," supplemented his talk. The attendance of 65 included 50 members of the Pittsburgh Section.

ROCHESTER

ENCLOSED STAIR TOWERS as a safe means of exit in case of hotel fires were recommended by Calvin G. Lauber, engineer for the New York office of the National Board of Fire Underwriters, in a talk on "Fire Safety in Hotels" at the February meeting. Dealing particularly with the Winecoff Hotel disaster in Atlanta, Ga., the speaker stated that the enclosed stair towers should not be used as chimneys to vent smoke and flames. A second recommendation was a sprinkler system. Mr. Lauber questioned the recommendation of a Chicago architect that elevator shafts be used for vents in case of fire. Two local hotel managers participated in the discussion that followed his talk. The meeting was a joint session with the Rochester Engineering Society and the local section of the American Society of Mechanical Engineers.

SACRAMENTO

ASCE DIRECTOR FREDERICK W. Panhorst attended one of the February luncheon meetings and spoke on current activities of the Society and problems facing the Board. At another meeting, T. Y. Lin described bridge engineering in China and the difficulties overcome during the Japanese invasion. Mr. Lin, now assistant professor of civil engineering at the University of California, spoke from the vantage point of having been in China during the war. Speakers at the other luncheon meetings were Dr. James F. Bursch, superintendent of the Sacramento Unified School District, who discussed education in Germany under the Occupation forces; and H. C. Briggs, water resources engineer for the U.S. Geological Survey, who described the establishment of gaging stations and office procedure in Venezuela.

SAN DIEGO

WIVES OF THE members were guests of the Section at the annual Ladies Night celebration. Following dinner, the meeting was turned over to a special program committee consisting of C. W. Capwell and Paul Beerman, who delighted the group with an unusual repertoire of entertainment.

ST. LOUIS

THE FACT THAT the Society has developed from the purely technical and honor society it was during the first 75 years of its existence into an organization vitally interested and very active in engineering welfare and professional advancement was emphasized by ASCE Past-President W. W. Horner in a talk before the February luncheon meeting. Mr. Horner discussed the Society's Local Section and Student Chapter activity and its interest in employment conditions, in classification and compensation schedules, and in establishing engineering as a real profession. This diversified program of activity has entailed an essential increase in operating funds, he pointed out, urging that the membership sign the petition to bring the two constitutional amendments to ballot. In the discussion that followed his talk, Mr. Horner indicated that conditions appear favorable for an amendment to the Wagner Act to meet the objections of the professions.

SAN FRANCISCO

THERE WAS AN attendance of more than 200 at the February dinner meeting. In the technical program scheduled for the occasion, Fred J. Grumm, assistant highway engineer for the California State Division of Highways, spoke on the present condition of the state highway system and indicated needed improvements.

SEATTLE

STUDIES ON THE development and flood control of the Green-Duwamish River basin were discussed at the annual meeting on February 12. In an outline of the project, W. H. Nelson stated that King County and the City of Seattle are very much in need of sites for industry and pointed out the fact that the Green-Duwamish River valley is well suited to industrial development, there being ample railroad facilities and an abundance of cheap electrical power. He also commented briefly on the feasibility of various schemes for flood control. Those taking part in discussion of the proposed project included Nat Carle, William Morton, and George Hopkins. Finally, the Section adopted a resolution similar to that passed by the Seattle Chamber of Commerce, favoring the comprehensive development of the river basin with a view to obtaining the best use of the area and recommending flood control only in so far as economically feasible. During the evening, certificates of life membership were presented to Ray M. Murray, M. D. Williams, Oscar A. Piper, and Hans Mumm, Jr. New officers for the Section are: E. B. Crane, president; Bertram P. Thomas, vice-president; and Thomas H. Campbell, secretary-treasurer.

SOUTH CAROLINA

THE ANNUAL WINTER meeting—consisting of two technical sessions, a luncheon, business meeting, and banquet—was a joint meeting with the South Carolina Society of Engineers. The list of scheduled speakers included: C. R.

McMillan, state highway engineer, Columbia, S.C.; S. C. McMeekin, of the South Carolina Electric & Gas Co., Columbia; L. A. Emerson, of the Tomlinson Engineering Co., Columbia; F. H. McDonald, of the Research Institute, Charleston; I. A. Kahn, of the Kahn Construction Co., Columbia; Dean S. B. Earle, of Clemson College, Clemson; L. S. LeTellier, head of the engineering department at the Citadel, Charleston; R. L. Sumwalt, dean of engineering at the University of South Carolina, Columbia; R. M. Cooper, director of the South Carolina Planning and Development Board, Columbia; L. S. Jeffords, chief engineer of the Atlantic Coast Line Railroad, Wilmington, N.C.; and A. H. Ward, district agent, Clemson College Extension, Aiken, S.C. During the business meeting, the following officers were elected: C. P. Roberts, president; D. D. Curtis, vice-president; and A. E. Johnson, secretary-treasurer.

SYRACUSE

A REPORT ON recent activities of the newly organized Joint Committee of New York State Local Sections was presented by Earl F. O'Brien, chairman of the committee, at the February meeting. Later in the evening, the Section met with the Technology Club of Syracuse to hear Colonel Hunt, of the Buffalo Engineer District, lecture on the Onondaga flood control project. There were about 100 present. At another meeting, Richard G. Coulter was elected secretary-treasurer to fill the vacancy caused by the resignation of J. O. Eichler. Mr. Coulter, who is chairman of the Section's Committee on Economic Conditions, presented a tentative report of the committee.

TACOMA

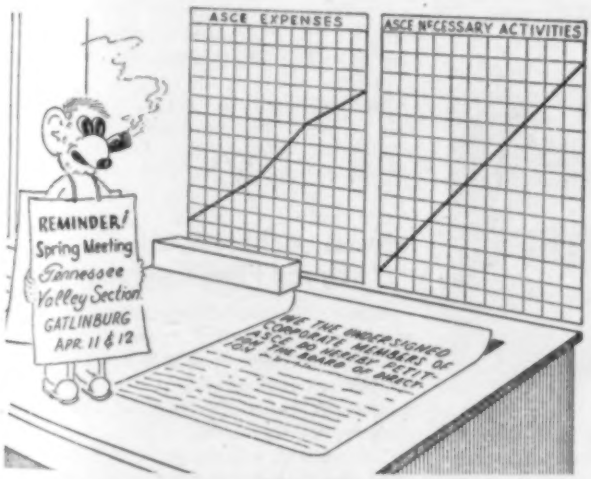
THE ANNUAL LADIES NIGHT attracted an attendance of almost 100. Fred M. Veatch, retiring president of the Section, led the group in community singing between the dinner courses. Later Mr. Veatch spoke briefly, summarizing the year's activities and thanking the members for their support. In his acceptance speech, Charles E. Andrew, newly elected Section president, outlined the aims of the Section for the coming year. A program of music, dancing, and a magician's performance had been arranged for the rest of the evening.

TENNESSEE VALLEY

ENGINEERING PROBLEMS CONFRONTING Chattanooga were discussed at the March 11 meeting of the Chattanooga Sub-Section by five members of subcommittees of the Chattanooga Resources Utilization Board. Those appearing in the symposium were Walter G. Davies, who spoke on the city street plan; H. O. Murphy, whose subject was the county highway plan; Thomas Lebby, who discussed railroad location; Lewis Schmidt, Jr., who described sewerage problems; and A. F. Porzelius, who spoke on financing the city plan.

Speaking on "Five Ways to Stimulate Development Through Planning" at the March 12 meeting of the Knoxville Sub-Section, Harold V. Miller pointed out that the state of Tennessee has been one of the foremost states in carrying planning activities into local communities. Mr Miller, director of the East Tennessee office of the State Planning Commission, said that, in this work, five major fields of activity are developed: state planning, local planning assistance, industrial development, general research, and community service. To carry on the work more effectively at the local level, four regional offices serve communities in their respective districts.

The initial meeting of the newly formed Oak Ridge Sub-Section took place at Oak Ridge on March 15, with an attendance of 21 Oak Ridge members and about 10 from the Knoxville and Chattanooga Sub-Sections. W. P. Cornelius was elected vice-president, and W. A. Niles, secretary-treasurer.



COVER OF MARCH "TENNESSEE VALLEY ENGINEER" advertises spring meeting of Tennessee Valley Section—to be held at New Gatlinburg Inn, Gatlinburg Tenn., April 11 and 12—and calls attention to petitions now in circulation for changes in constitutional amendments

TEXAS

THE LABOR PROBLEM from the viewpoint of management was discussed by John Scott, attorney, at the February luncheon meeting of the Fort Worth Branch. Mr. Scott's talk elicited considerable discussion, and there was also a discussion of the Society's role in collective bargaining.

VIRGINIA

WHILE ENGINEERS' PRIMARY concern will naturally be for their profession, they should also concern themselves with the affairs of the nation and the world and should take an active interest in the shaping of local, state, and national policies, ASCE President E. M. Hastings told members of the Virginia Section. Speaking at the annual meeting, which was held in Richmond on February 14, Mr. Hastings cited the work of the Society in its 94 years of existence, and pointed to the tremendous advances that have been made in recent years in helping the younger men in the Society and in increasing the scope of ASCE interests and activities. Other guests of the Section for the occasion included ASCE Vice-President Gail A. Hathaway; ASCE Directors Roy W. Crum and W. R. Glidden; James E. Jagger, Assistant Secretary of the Society; and E. L. Chandler, Eastern Representative of the ASCE. Life memberships in the Society were presented to L. M. Gray, Richard Messer, R. Stuart Royer, C. M. Hunter, C. H. Locher, Frank M. Weakley, and T. Judson Wright. The annual election of officers, which preceded the banquet and evening meeting, resulted as follows: R. Stuart Royer, president; F. A. Rice, P. H. McGahey, and Donald S. Wallace, vice-presidents; and John W. Roberts, secretary-treasurer.

WISCONSIN

LEGISLATIVE AND FINANCIAL aspects of the proposed Milwaukee Expressway System were covered by R. W. Gamble, superintendent of the Milwaukee Bureau of Street Construction and Repairs, at the February dinner meeting. Speaking on the same program, Howard Ilgner, superintendent and chief engineer of the Milwaukee Bureau of Electric Service, discussed the need for expressways in urban areas, and Martin E. Bruening, traffic control engineer for the Bureau of Electric Service, described in detail the origin of traffic control methods. The latter illustrated his talk with slides of a survey recently completed in Milwaukee. The question of what action the Section should take on broad civic problems was then discussed by Willis D. Kimmel, chairman of the Section's Special Committee on Civic Problems. After discussing Mr. Kimmel's report, the Section decided to establish a permanent standing committee on civic problems.

NEWS BRIEFS

ABOUT ENGINEERS AND ENGINEERING

California Legislature Makes a Study of Highway Safety

ONE OF GOV. EARL WARREN'S chief reasons for demanding immediate action by an extraordinary session of the California Legislature is the fast-mounting fatality and injury rate on the state's highways. Traffic accidents killed 41 and injured 851 of every 100,000 persons in the state in 1946, Governor Warren declared. Without final figures, at least 3,800 people met violent death on roads and streets last year. Approximately 80,000 were injured.

Standards of road construction for building an adequate, safe highway system in California are given in the article that appears on page 22 of this issue of CIVIL ENGINEERING. This article is based on one chapter of a comprehensive report prepared for the California Legislature by a joint fact-finding committee on highways, streets and bridges.

"There was a time when California had the outstanding highways in the Union, but they have failed to keep abreast of population growths and transportation demands. Their inadequacy today is apparent to everyone—and in tragic terms," Governor Warren said. He pointed out that 5,000 of the state's 13,086 miles are two-lane roads less than 20 ft wide, while 360 miles are of the three-lane type. Two-lane roads are bottlenecks and three-lane ones are death traps, he declared. Against this, he cited the desperate need for at least 2,500 miles of divided highways to protect lives and eliminate congestion.

It was the Governor's belief that the state's finances were badly out of balance between needs and revenues, and they are getting worse all the time, he added. He announced that in preparing the budget for the coming fiscal year, it was necessary to defer some $40,000,000 in urgently needed work. "The plans were ready and the projects approved by the state highway commission, but the necessary funds were not available," he said.

Funds provided by gasoline taxes, federal aid, motor vehicle fees and taxes on diesel fuel will allow only $27,000,000 for new construction and reconstruction on California highways this year, Governor Warren continued. He compared this with the estimate made in 1943 that work costing $700,000,000 would be required in addition to a regular building program to provide an adequate highway system.

In discussing highway revenues, Governor Warren expressed a belief that trucks and buses, operating commercially or privately, make greater demands upon a highway system and therefore should pay comparable taxes for comparable use of the highways. "It is only fair, and coincides with national experience, that the heavier vehicles should pay an additional tax," was the Governor's statement.

This information was excerpted from a news release furnished to CIVIL ENGINEERING by Charles M. Upham, engineer-director, American Road Builders' Association.

Summer Program Is Planned for Rocky Mountain Hydraulic Laboratory

PLANS ARE NOW being made for the second season of operation of the outdoor summer hydraulic laboratory near Allenspark, Colo. Establishment of this project, which is named the Rocky Mountain Hydraulic Laboratory, was reported in the January 1946 issue of CIVIL ENGINEERING, page 41.

During the first season of operation a small group of engineering "pioneers" opened up an access road, built a bridge, prospected for and found sand deposits large enough to take care of the laboratory's needs for construction and experimental work, and built a small shop building. All members of the group, which included Gerard H. Matthes, Hon. M. ASCE, consulting engineer of New York; Prof. C. J. Posey, M. ASCE, of the State University of Iowa; Prof. Ralph W. Powell, M. ASCE, of Ohio State University; Prof. Henri J. Putman of the Université Laval, Quebec; Lyman Flook, Jun. ASCE, of the U.S. Bureau of Reclamation; and Prof. John H. Dawson, Jun. ASCE, of the University of Colorado, expect to return for at least part of the coming season to carry on the program started last summer.

SHOP BUILDING, built in 1946 season, houses equipment for Rocky Mountain Hydraulic Laboratory.

The organization, which is under the direction of a board of trustees headed by Mr. Matthes, owns the 20-acre site near the Rocky Mountain National Park. The area includes a quarter-mile reach of the crystal-clear North St. Vrain Creek. In addition to research projects to be conducted at the laboratory, inspection trips to nearby engineering projects and technical meetings with visiting engineers are planned.

Students of hydraulics and members of the hydraulics sections or divisions of ASCE, ASME, American Society for Engineering Education and American Geophysical Union are welcome to join in the activities of the laboratory. Those who wish to participate in the laboratory's program, or to use its facilities for research, should communicate with Prof. R. W. Powell, The Ohio State University, Columbus 10, Ohio, or Prof. C. J. Posey, State University of Iowa, Iowa City, Iowa.

"Highways Ahead" Film Is Available for Group Use

SOMETHING NEW in the way of industrial films has been produced for "Caterpillar" by The Calvin Co., motion picture producers of Kansas City, Mo. The 16-mm, full-color sound film, titled "Highways Ahead," is intended to awaken the public to a need for maintaining and building superior roadways.

The famed Pulaski Skyway in New Jersey and the Pennsylvania Turnpike are used to show how some of our highway problems can be solved. Sections of these two highway systems are analyzed to show how safety and efficiency were figured into their construction. The importance of these two factors in our future highway construction is stressed throughout the picture.

All companies or groups interested in viewing this new film should contact the Advertising Department of Caterpillar Tractor Co., Peoria, Ill.

International Hydraulics Group Plans Conference

AFTER SIX years of inactivity due to the war, the International Association for Hydraulic Structures Research has been reactivated and is making plans for its first post-war meeting, to be held in Stockholm, Sweden, in June 1948.

This meeting will precede that of the Congress des Grands Barrages, also scheduled to be held in Stockholm, thus making it easy for those interested to attend both conferences. Following the second conference, there will be excursions to various dams and hydraulic works in Sweden.

The last meeting of the International Association for Hydraulic Structures Research was scheduled for Liége in September 1939 but was called off at the last minute because of the war. However, reports and papers scheduled for presentation were published in Stockholm early in 1940 and distributed to the members of the association.

Membership in the organization is open to both individuals and groups, and applications for membership are now being accepted. Individuals eligible are: (*a*) professors in hydraulics or in a cognate branch at a university or college; (*b*) directors of hydraulic laboratories or employees doing responsible work at such laboratories; (*c*) members of leading scientific and technical associations. Groups eligible are: (*a*) institutions for hydraulic works or cognate ranges at a university or college; (*b*) hydraulic laboratories; (*c*) national committees or analogous committees of the World Power Conference, of the Congrès des Grands Barrages, and of the Permanent International Association of Navigation Congresses; (*d*) public institutions which project, execute, and supervise hydraulic works.

Those wishing to become members of the International Association for Hydraulic Structures Research should communicate with the American member of the permanent committee, Dr. Lorenz G. Straub, M. ASCE, Director of the St. Anthony Falls Hydraulic Laboratory, University of Minnesota, Minneapolis, Minn.

Building Officials Have New Six-Point Program

A SIX-POINT PROGRAM for building-code reforms was announced by the Building Officials Foundation following its organization meeting in New York on March 6. The six points of the program are:

1. To encourage the adoption of the basic building code promulgated by the Building Officials Conference by all communities, to the end that a country-wide uniform code be established and local codes kept up to date.
2. To assist communities in the administration of their building laws and regulations.
3. To reconcile local building codes with advances in the art of building so that structural design, equipment, construction materials and methods may be progressively improved in the public interest.
4. To provide uniform testing procedure in consultation with industry in determining the adequacy of testing equipment, and for the evaluation of the integrity of equipment, materials and methods of construction.
5. To make known to building officials everywhere the results of tests promptly and in a manner compatible with the needs for such data in administering building rules and regulations.
6. To keep building and other municipal officials concerned with public health and safety, manufacturers, producers, architects, mortgage and equity financiers, government officials concerned with construction, building labor leaders, materials' dealers, and other factors in the building industry informed of advances in building requirements and code administration and to supply them with news and data pertaining to better building and construction practices.

The Building Officials Foundation was established in Memphis last fall by the Building Officials Conference of America, Inc. At the organization meeting of the Foundation on March 6, the Board of Governors elected Andrew J. Eken, president of Starrett Brothers & Eken, New York builders, chairman of the Board of Governors and chairman of the Foundation's executive committee.

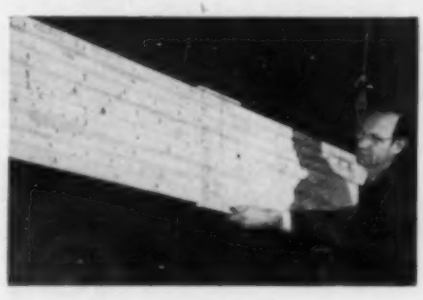
Get Your Paper Started

LITTLE TIME REMAINS to enter papers in the "Design-for-Progress" arc welding award program, which ends on June 1, 1947. Further delay may minimize your chances for winning one of the 452 awards totaling $200,000. Details of the arc welding contest sponsored by The James F. Lincoln Arc Welding Foundation were initially announced in CIVIL ENGINEERING for June 1946, page 284.

Some suggestions for participants are listed as follows: (1) Familiarize yourself with the rules. Read them over carefully several times. (2) Determine under which of the 15 classifications your material falls. (3) Do a thorough job—it can spell the difference between a winning and a non-winning paper.

Classifications of special interest to civil engineers are: Railroad; Structural, Buildings, Bridges; Houses and Miscellaneous; Commercial Welding; Maintenance; Research and Education.

Copies of the rules can be obtained by writing to The James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.



MAMMOTH SCALE MODEL of 10-in. slide rule is used by Dean Lee Johnson, M. ASCE, School of Engineering, University of Mississippi, Oxford, Miss., to demonstrate his revolutionary operating technique, which allegedly changes basic method of multiplication for first time since slide rule was invented by Gunter and Oughtred over 330 years ago. Compared with orthodox method, Dean Johnson explains, new procedure requires from one-third to one-twentieth amount of movement and about one-half as much time; it substitutes use of eye and head for use of hand. Running off of rule, necessitating resetting, is impossible under new method.

Downward Trend in Building Costs Is Predicted for 1947

THERE IS GOOD REASON to believe that the peak in building costs has been reached and that the future trend will be downward, Tyler S. Rogers, president of the Producers' Council, national organization of building product manufacturers, said in speaking before the Mortgage Bankers' Association in Washington, D.C., on March 1.

"While it is possible that the cost of building homes and other structures might drop as much as 20 percent below 1946 peaks during the year, the trend will depend so largely on wage rates and on the productivity of construction labor that no definite forecast can be made," Mr. Rogers said.

"Shortages of essential building materials are disappearing so rapidly that 1947 may well become a record home building year which will see about one million new permanent-type housing units started, as compared with about 650,000 in 1946." Considering the fact that 200,000 or more units were in the process of construction at the beginning of the year, Mr. Rogers estimated that about one million units will be completed in 1947.

Engineer Reports on Traffic Problems of Williamsport, Pa.

PROHIBITING PARKING in business districts is a last resort in solving traffic congestion and accident problems, since such districts should supply space for movement and parking. This was one of the points made in a luncheon address before city officials of Williamsport, Pa., by Henry K. Evans, Assoc. M. ASCE, director of traffic engineering for the National Conservation Bureau, accident prevention division of the Association of Casualty and Surety Executives. A traffic survey of the city has just been completed by the National Conservation Bureau, on which a detailed report will be rendered at a later date. The survey is one of a series conducted by the Bureau in towns and cities of varying sizes.

"Some general conclusions made in Williamsport are typical of many cites ranging from 50,000 to 100,000 population," Mr. Evans said. "They show that traffiic congestion is caused by three things: old-fashioned traffic signal systems; double parking of automobiles, trucks and buses; left-turning vehicles."

Mr. Evans made eight recommendations for immediate action:

1. Change traffic-control signal timing to afford progressive movement. Smoother flow can be attained by a few simple changes. However, a new, modern system with separate signal controllers at every intersection is needed.
2. Install truck loading zones at the curb at nine locations.
3. Strictly enforce regulations prohibiting double parking—a major cause of traffic delay.
4. Strictly enforce regulations prohibiting parking in bus loading zones.

5. Lengthen bus loading zones to conform with national standards, and encourage bus drivers to pull close to curb.

6. Prohibit left turns off two main streets between 4 and 6 p.m., at signalized intersections in four-block congested area.

7. Make Laurel Street one way northbound to take care of left turns not allowed at adjacent intersections.

8. Eliminate double-amber in traffic signal lights at two "worst corners." This system of timing, where amber appears twice in each light cycle, once before green and again before red, has been the direct cause of most of the accidents at these two high-accident-frequency intersections.

Number of Apprentices in Building Trades Increase

DESPITE THE CONTINUED seasonal drop-off in construction, the number of apprentices in the building trades is still increasing, the Apprentice-Training Service, U.S. Department of Labor, has determined.

While expenditures on new construction were lower in January than in December, the number of apprentices in the building trades increased 3 percent, from 88,347 listed at the end of December, to 91,093 recorded at the end of January. The January figure is based on 3,802 reports received from all parts of the country. The following reasons were given by the Apprentice-Training Service for this increase in apprentices during the off season for construction:

1. Their services are required to complete construction begun earlier in the year.

2. Alteration, maintenance and repair work is giving employment to many new apprentices.

3. Contractors and unions, with an eye on the approaching building season, are determined to provide an adequate work force by employing and training more apprentices now.

Mississippi River Commission Issues New Navigation Maps

NEW MAPS OF the Mississippi River from the mouth of the Ohio River at Cairo, Ill., to the Gulf of Mexico—prepared to an approximate scale of one inch to one mile—have been released by the Mississippi River Commission. This set of maps is republished annually, the current edition (1946) superseding those subsequent to the 1933 edition. The detail maps, Nos. 1 to 62, show general information for distances varying from one to eight miles on either side of the river, depending upon the location of the river on each respective map. Channel lines are represented, and their names and numbers are overprinted in red. The mean low water line is shown and represents the bank line at low-water stage.

The maps are black-line photo-offset reproductions. The complete set is priced at 75 cents, and individual sheets are not available for sale. Remittance should be made payable to the Treasurer of the United States, and mailed to the Mississippi River Commission, P.O. Box 80, Vicksburg, Miss.

Need for Knowledge of Soil Behavior Spurs Research in Soil Mechanics

KNOWLEDGE OF SOIL BEHAVIOR in its vital relation to construction has spurred research in soil mechanics, a project of the Engineering Foundation, Dr. A. B. Kinzel, chairman of its Board, said yesterday. Although the building of structures supported by the soil, or constructed of soil, dates back many thousands of years, there is still not enough scientific data to enable engineers to design safe structures with maximum economy and certainty. A research program is now under way at Northwestern University under the direction of Prof. J. O. Osterberg, Jun. ASCE, Research Engineer. It is a project of the Engineering Foundation, whose offices are in the Engineering Societies Building, 29 West 39th Street, New York. An account of the current status of this project will appear in the forthcoming annual report of the Foundation.

Physical Properties and Stresses

The general procedure of soil mechanics is to combine the physical properties of soils, measured by laboratory procedures, with stresses, computed by a theoretical or semi-empirical process, to determine the action of soil under or in an engineering structure, the report said.

Broadly speaking, only two general types of soil action are of interest to the engineer: one, failure of the soil due to insufficient strength to sustain the applied loads; and two, deformations of the soil too great for the supported structure to sustain without failure or improper functioning. These two actions are quite independent and must be treated separately.

The first includes the pressure of earth on retaining walls, the ultimate bearing capacity of footings resting on soil, the stability of earth slopes, and all actions generically termed "problems of rupture." The underlying philosophy of analyses of these actions is determination of the maximum load the soil can sustain without exceeding its maximum strength determined or extrapolated from small-scale laboratory tests which have been compared and correlated with past performance.

The second action includes settlements of buildings, footings, pavements, etc., and distribution of pressures on walls, tunnels, etc., all termed "problems of deformation." Analysis of these problems requires approximation, by some theoretical method, of the stresses in the soil which, combined with stress-strain relationships measured in the laboratory, result in strains that can be summed up to give deformations.

Naturally, soils are the products of the geologic process of disintegration, transportation and deposition and vary widely in physical character with even minor variations in the geologic processes and history. For this reason it has been impossible to codify the properties of soils in groups. In general it is necessary to measure the strength and deformation characteristics of each soil as it exists in nature.

A study of methods to secure "undisturbed soil samples" was undertaken in 1938 at Harvard University, as such samples are the first requisites for determining natural soil properties in the laboratory. Dr. M. J. Hvorslev, Assoc. M. ASCE, as research engineer for the Engineering Foundation, directed the work which included the development of "samplers," tools for obtaining undisturbed samples of soil. The U.S. Waterways Experiment Station at Vicksburg, Miss., as authorized by the Office of Chief of Engineers, U.S. Army, has cooperated in preparing a complete report on sampling methods.

Panama Canal Tests

The Engineering Foundation's soil mechanics research has been aided considerably by Joel D. Justin, M. ASCE, consulting engineer of Philadelphia, and Gen. J. C. Mehaffey, Governor of the Panama Canal, who furnished a complete se of reports on the results of laboratory tests and field bearing tests on the Cucaracha formation in the third locks area of the Panama Canal. The field results include bearing tests on 8-, 16-, and 40-in. dia plates and a large, long-time test on a concrete mat 40×50 ft loaded to an average maximum load of 10 tons per sq ft. This is the only case on record where such a large area has been loaded in the field under carefully controlled conditions with complete records of performance.

Record Shows Building Construction Deficiency

"RECENT HOTEL DISASTERS have demonstrated the seriousness of existing fire hazards with which American cities have temporized too long," B. L. Wood, consulting engineer for the Committee on Building Codes of the American Iron and Steel Institute, told a recent meeting of the American Institute of Architects.

"No building containing open stairways or shafts can be regarded as fireproof or fire safe," he said, "but according to reports there are 372 hotels in New York City which contain such shafts and stairways.

"The fire record, with 11,000 deaths and 561 million dollars' property loss in 1946, clearly shows the deficiency in building construction and the inadequacy of building laws."

Mr. Wood said a recent study by architects indicated that apartment houses can be built of fire-resistive construction in New York on an economical basis and yield higher income than those constructed of combustible materials.

Results of the study have been published jointly by the American Iron and Steel Institute, the American Institute of Steel Construction and the Steel Joist Institute.

R. Robinson Rowe, M. ASCE

"WHILE JOSHUA KIDDER, our Guest Professor, is setting up his blackboard, let's set the stage for his nonagon with a little history. Euclid couldn't construct one with compass and straightedge, and the ancient problem was recognized as a variant of the attempt to trisect an angle. In 1837, Wantzell proved this impossible. Later De Morgan showed that the ratio of side to radius for the nonagon was x in the cubic, $x^3 - 3x + \sqrt{3} = 0$, making the proof of impossibility follow from the proved stubbornness of cubics toward Euclidean tools. Ready, Josh?"

"All set, Noah. I've marked on the blackboard the outline of the nonagon (Fig. 1), of which points A, B and C are given. I asked for the center, using only a compass with its reach limited to AB."

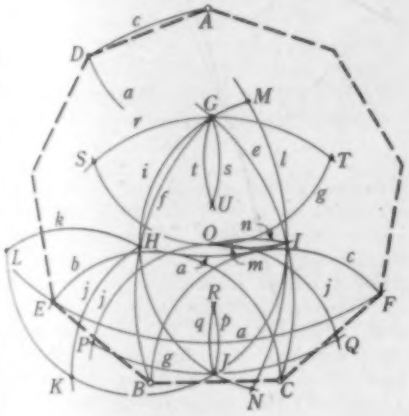


FIG. 1. GIVEN VERTICES A, B, C of regular nonagon, to find center, U, with a short compass.

"Professor Kidder was just stingy," complained Joe Kerr. "He might as well have given all nine vertices, since it's easy to find the others when any three are given. Using A and C as centers and AB and BC as radii, I intersected arcs at D. Similarly I found E and F and had the equilateral triangle AEF and had then to find its center, which is the center of the nonagon. This I could find by bisecting the base and trisecting the altitude, but I ran out of rope. The compass is too small."

"You mean the triangle is too large," corrected Cal Klater. "But if you strike 3 arcs with EC as radius and A, E and F as centers, you have the smaller central triangle GHI, for which the compass is big enuf. I'll show you."

And Cal did. The order of his steps is the alphabetical order of the designated intersections, and the centers of his arcs are indicated by small letters.

"You're an *arctist*," admitted Professor Kidder. "You're construction is more symmetrical than mine, but I didn't need the smaller triangle. I have a method for dividing a distance into any number of equal parts with a compass reaching only the given distance. I'll show you later."

"Show me too," begged Professor Neare, "and thanks for coming. Remember your promise to tell what you found buried at the center?"

"Just an empty chest with a scrawl on the cover, 'Kilroy was beat!'"

"And so was Kidder—too bad. Remember Al E Dayde? He writes that three chaps in Phoenix asked his price for surveying an acre and he was cautious enuf to ask them its shape. They said it would be easy because all dimensions were even feet and then admitted there were 3 rectangular lots. Mr. Alack said his was as long as Black's and as wide as Clack's was long. Mr. Black said his was as wide as Clack's and Mr. Clack begged Al to make his as big as possible. Al is still figuring how big the Clack tract is."

Several pointed out that the tape could be pulled tight enuf to serve as a straightedge and its graduations used for bisection and trisection. Professor Josh Kidder, who is really Henry Kuphal, insists he was alone and couldn't be two chainmen at once.

ASTM Headquarters Building Is Dedicated in Philadelphia

DEDICATION CEREMONIES for its new Headquarters Building at 1916 Race Street, Philadelphia, were held by the American Society for Testing Materials on February 26. A selected group attended the ceremony at 4:00 p.m., including Howard T. Critchlow, ASCE Director for District 4, who represented ASCE on this occasion. The inscription unveiled at that time reads:

> "This building was given by the members of the Society as National Headquarters and is dedicated to the advancement of education and science and to service to industry and to the nation."

About 450 were present at the headquarters dedication dinner held at the Benjamin Franklin Hotel in the evening of the same day. A feature of the occasion was the address by Edward U. Condon, director of the National Bureau of Standards.

The purchase and enlargement of the building was made possible through gifts from the ASTM members totaling about $160,000. The building is a four-story structure next to the Academy of Natural Sciences. Improved working facilities are provided for the society's staff of some 43 people, and the building has enhanced lobby facilities, members' lounge, three committee rooms for smaller meetings, and shipping and storage facilities for a large number of the Society's publications, including the separate standards.

BY RECENT VOTE the San Diego Authority has been annexed to the Metropolitan Water District of Southern California to take water from the Colorado River Aqueduct.

ONE OF THE LONGEST transmission spans in the United States is the new Pennsylvania Power & Light Co. span across the Susquehanna River at Millersburg, Pa.—straight-line distance between terminals, 5,366 ft.

SOME 1,200 ENGINEERS from 30 countries attended the International Technical Congress in Paris, September 16–21, 1946, and went on record to the effect that engineers should coordinate their efforts nationally and internationally to advance human well-being and world peace.

IN 1867 BURSALL HOOLEY conducted the first successful experiments in central heating by transmitting heat through pipes for a distance of 100 ft from his home.

THE FIRST ALL-ALUMINUM BRIDGE span in history was recently installed on the new Grasse River bridge at Massena, N.Y. It is a 100-ft span and weighs only 53,000 lb as compared to 128,000 lb for similar spans of heavier metal (CIVIL ENGINEERING, December 1946).

SOUND TRAVELS 4,800 FT PER SEC through water, or more than four t'mes as fast as through air. Resounding subsurface sound waves can be made to locate fish, map the ocean bottom, even aid in the navigation of a vessel. This principle, called "sonar," helped save our tanker fleet from utter destruction by U-boats; later it guided invasion fleets safely over uncharted shoals and reefs.

A NEW KIND of tire is announced by B. F. Goodrich for use on rails or roads.

Wool Gatherings

With the printing of this column a new monthly feature is inaugurated in CIVIL ENGINEERING. The news tidbits used herein are not necessarily of engineering or Society interest, but are of such general nature as to be read by all Society members, their wives and families. Conducting this column is Ralf R. Woolley, M. ASCE, president of the Intermountain Section of ASCE, who for a number of years has published a "News-Letter" for the Utah Society of Professional Engineers. Suggested "Wool Gatherings" can be mailed directly to Mr. Woolley at 303 Federal Building, Salt Lake City, Utah.—Editor.

Iowa Engineering Society Elects Officers for 1947

AT THE FIFTY-EIGHTH Annual Meeting of the Iowa Engineering Society—held February 18 and 19 at Hotel Fort Des Moines, Iowa—a new slate of officers and representatives for 1947 was installed. Many ASCE Members appear in the following list of new officers: President, Frank Kerekes, M. ASCE; president elect, William P. Nemmers; vice-president, C. M. Stanley, M. ASCE; directors, L. C. Crawford, M. ASCE, and Robert S. Casey; secretary, A. F. Faul; treasurer, E. F. Behrens.

Representatives chosen are: B. R. Kenworthy, Frank O. Laing, Ralph W. Tuller, L. E. Anderson, Assoc. M. ASCE, A. A. Baustian, Mark Morris, Assoc. M. ASCE, L. O. Stewart, M. ASCE, Theodore A. Hunter, Ned L. Ashton, H. G. Hershey, Reuben Miller, C. W. Baldwin, Richard W. Welden, Assoc. M. ASCE, L. W. Mahone, Assoc. M. ASCE, L. J. Schiltz, Robert S. Casey, Floyd K. Brown, D. N. Blake, Assoc. M. ASCE, P. K. Duvall, Assoc. M. ASCE, L. A. Winter, Keyes C. Gaynor, Assoc. M. ASCE, Floyd Campbell, Louis E. Kuester, and B. W. Dutton.

New Publications

TO BUILD AN UP-TO-DATE salary structure, the New York State Salary Standardization Board has been conducting a survey of the scale and range of salaries paid by private industry and federal and local governments for services comparable with those performed by state employees. Results of the study have been published in a 300-page volume, entitled *Survey Report of the Salary Standardization Board*. The report may be obtained from the State of New York Department of Civil Service, Albany 1, N.Y., at a cost of $1.50.

SUMMARIES OF MONTHLY discharge at all stream-gaging stations in Ohio, prior to September 30, 1944, have been brought together in one volume, *Ohio Stream Flow*, which is issued as Engineering Experiment Station Bulletin No. 127. The study—a joint project of the Ohio State University Engineering Experiment Station and the Ohio Water Resources Board—may be purchased from the Ohio Water Resources Board, 555 East Broad St., Columbus 15, Ohio. The price is $1. Carl V. Youngquist, Assoc. M. ASCE, is chief engineer for the Board.

TO ASSIST PUBLIC officials in designing subdivisions, with preferred characteristics, good sales appeal, and long-lived attractiveness to home owners, the Bureau of Planning of the New York State Department of Commerce has issued a manual entitled *Subdivision Control—A Step Toward Better Communities*. The manual may be obtained without cost from the New York State Department of Commerce, Bureau of Planning, 112 State Street, Albany 7, N.Y.

TOTAL NEW CONSTRUCTION in the United States for 1946, not including maintenance, reached more than ten billion dollars, according to the January 1947 report of the Office of the Housing Expediter. The survey, which is entitled *Veterans Emergency Housing Program*, states that a million construction units were begun during the year, and that a total of 661,900 units of all types was completed. More than two-thirds of these units were of permanent construction. Statistics in the report have been drawn from official sources. The report may be obtained from the Office of the Housing Expediter, Washington, D.C.

THE FREEWAY AS a planning solution to the problems of mass transportation, traffic, and congestion, is discussed in *Urban Freeways*, which has been prepared by the Committee on Urban Transportation of the American Institute of Planners and published by the American Transit Association. The 38-page booklet is graphically illustrated with photographs of actual traffic congestion and drawings of freeways and expressways designed to relieve congestion. It may be obtained without cost from the American Transit Association, 292 Madison Avenue, New York, N.Y.

PLANS FOR THE international control of atomic energy are outlined in "The First Report of the United Nations Atomic Energy Commission to the Security Council," which has been issued as the United States and the United Nations Report Series 8. Covering the work of the Atomic Energy Commission from June 14 to December 31, 1946, the report includes findings on the scientific and technical aspects of the problem of control and the first report on safeguards required to ensure the use of atomic energy for peaceful purposes only. The report is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at a cost of 25 cents.

SOURCES OF TECHNICAL assistance, including laboratories, specialized personnel, and unusual equipment available to the New York State manufacturer, are listed in the recently published "Directory of Research and Development Facilities at Educational Institutions in New York State." The Directory excludes facilities not of a technical nature as well as those available at commercial laboratories, as directories of these are already available. It may be obtained, without cost, from the New York State Department of Commerce, 112 State Street, Albany 7, N.Y. Several ASCE members—Gano Dunn, S. C. Hollister, Louis Mitchell, H. S. Rogers, Thorndike Saville, and L. K. Sillcox—served on the Advisory Committee on Technical Industrial Development that compiled the Directory.

"ABSTRACTS OF EARTHQUAKE Reports for the Pacific Coast and the Western Mountain Region" have been issued in mimeographed form for the period from January 1 to March 31, 1946, by the Seismological Field Survey of the U.S. Coast and Geodetic Survey. Copies of these reports may be obtained from the Supervisor, Western District, U.S. Coast and Geodetic Survey, 114 Customhouse, San Francisco, Calif., or from the Survey's Washington office.

ADVANCES IN FERROUS metallurgy made during the war will be recorded in a series of books to be published by the Alloys of Iron Research, a project of the Engineering Foundation. The first volume—in preparation now, under the direction of Frank T. Sisco—will contain a description of the characteristics and properties of the many new alloy steels developed during the war. It will also summarize the new principles of plastic deformation at elevated temperatures, which have proved of value in developing new steels for high and low temperature use, as in jet-propelled airplanes that operate at high altitudes where temperatures are low. Alloys of Iron Research, a major research project of the Engineering Foundation, was reestablished recently after a period of wartime inactivity. It was begun in 1930, with financial support from the Foundation and from major steel producers, to review the important research work on steel and to correlate the data thus obtained for the benefit of industries manufacturing or using steel.

WARTIME DEVELOPMENTS IN the technique of road design and construction have led to the issuance of Bulletins Nos. 4 and 5 by the British Department of Scientific and Industrial Research in cooperation with the Ministry of War Transport. Bulletin No. 4 is entitled "Soil Survey Procedure and Its Application in Road Construction," and Bulletin No. 5 deals with "Recommendations for Open-Textured Asphalt Carpets." Bulletin No. 4 sells for 9*d*., and Bulletin No. 5 for 3*d*. Inquiries should be addressed to the Road Research Laboratory, Harmondsworth, West Drayton, Middlesex, England.

PROBLEMS ARISING in the disposal and utilization of a wide variety of industrial wastes are covered in "Proceedings of the Second Industrial Waste Conference"—recently issued as Bulletin No. 60 of the Engineering Extension Department at Purdue University. The 183-page illustrated bulletin includes a timely paper on industrial waste treatment in Germany—by Lt. Col. J. J. Gilbert, former special representative of the U.S. Surgeon General in Germany—and a series of "workshop" discussions on special problems. Inquiries concerning the bulletin should be addressed to the Department of Engineering Extension, Purdue University, Lafayette, Ind.

TO SUPPLY ENGINEERS and public officials with a basis for better and more economical design of structures affected by flood flow, the Ohio Water Resources Board has issued Bulletin No. 7, entitled "Floods in Ohio, Magnitude and Frequency." William P. Gross, Assoc. M. ASCE, is author of the 154-page report, which is a cooperative project of the Board and the Water Resources Branch of the U.S. Geological Survey. C. V. Youngquist, Assoc. M. ASCE, is chief engineer of the Ohio Water Resources Board. The bulletin may be purchased from the Ohio Water Resources Board, Columbus, Ohio, at a cost of $1 a copy.

WITH THE ISSUANCE of the January 1947 number of *Traffic Quarterly*, the Eno Foundation for Highway Traffic Control launched a periodical that will be devoted exclusively to the improvement of traffic conditions.

The editorial staff consists of Col. Robert C. F. Goetz, editor-in-chief; Roscoe Ellard, executive editor; and Charles M. Upham, M. ASCE, Wilbur S. Smith, Assoc. M. ASCE, and Charles S. Le Craw, Jr., associate editors. Inquiries concerning the new publication may be addressed to the Eno Foundation, Saugatuck, Conn.

RECOGNIZING THE NEED for clarification of terms and standardization of practices within the iron and steel industry, the American Iron and Steel Institute has issued a new revision of Section 8 of the Steel Products Manual, entitled "Hot-Rolled Carbon Steel Bars." The 93-page pamphlet includes chapters on manufacturing practices; quality classifications; standard and non-standard steels; standard practice tables; simplified practice recommendations; and marking, packaging, and loading methods. Copies of the manual may be obtained from the American Iron and Steel Institute, 350 Fifth Avenue, New York City. The cost is 25 cents a copy, postpaid.

Meetings and Conferences

AN INTENSIVE, ONE-WEEK educational conference for college and university professors who teach courses in diesel engineering has been scheduled for the week beginning June 23. Headquarters for the conference will be the Hotel LaSalle in Chicago. Registration will be in the Alumni Memorial Building at Illinois Institute of Technology, June 23, 9 to 10 a.m.

THE BOILER CODE COMMITTEE of the American Society of Mechanical Engineers has made arrangements to hold two public hearings in the Southwest on its proposed revision of the boiler construction code. The first of these hearings will be held at the Rice Hotel in Houston, Tex., on May 1, at 8 p.m., and on May 2, at 9:30 a.m. The second hearing will be held at the Biltmore Hotel in Los Angeles, Calif., on May 7, at 9:30 a.m.

RECENT DEVELOPMENTS IN combating and controlling corrosion will be discussed at the annual conference and exhibition of the National Association of Corrosion Engineers, to be held at the Palmer House in Chicago, April 7 through 10.

A SYMPOSIUM ON shock and impact will be a feature of the annual meeting of the Society for Experimental Stress Analysis, which will take place at the Stevens Hotel, Chicago, on May 15, 16, and 17. Inquiries should be addressed to the Society for Experimental Stress Analysis, P.O. Box 168, Cambridge 39, Mass.

DATES HAVE NOW been fixed for the Third Industrial Waste Utilization Conference, which will be held at Purdue University, Lafayette, Ind., on May 21 and 22. The Proceedings of the Second Conference are available to those who are interested, upon application to the university.

NEW IN Education

CLOSER COOPERATION of colleges and universities with federal agencies is the aim of the newly organized College-Federal Service Council, which covers the Second Civil Service Region of New York and New Jersey. At a conference of the Council held in New York City, a plan was proposed for working out a program whereby federal agencies can compete successfully with other employers for best qualified college graduates. Spokesmen for federal agencies agreed unanimously that high-caliber graduates are needed, especially in the fields of engineering and the physical and biological sciences.

During the conference, which was attended by representatives of metropolitan schools, various suggestions were advanced for accomplishing this aim:

1. Use students during summer vacations to get federal experience, and from the best trainees select those for permanent positions. Also a program was suggested whereby students would be permitted to complete college studies while holding federal positions.
2. Compile registers of eligible candidates prior to graduation so that federal positions can be offered to members of the graduating class before they actually leave school.

It is expected that as soon as the organization is fully set up, local committees will be established to represent federal agencies and schools in their respective communities.

A RECORD ENROLLMENT of 5,620 students at the Georgia School of Technology for the winter quarter has been made possible, despite the lack of adequate classrooms and laboratories, through the continual use of all facilities from 7:00 a.m. to 10:00 p.m. every day except Saturday, when classes end at 5:00 p.m. In order to take care of the additional load, 21 full-time and part-time instructors and consultants were added to the faculty with the approval of the Board of Regents.

EXPANSION OF the civil, mechanical, and industrial engineering curricula at Lehigh University, effective this fall, will include changes in present course content, introduction of 19 new courses, additional field trips, restoration of a four weeks' summer term at the end of the freshman year in surveying and machine-shop practice, and a required eight weeks of industrial employment between junior and senior years. Wide-sweeping changes in the industrial engineering curriculum include the addition of six new courses in the senior year to provide for advanced study in production control, quality control, product engineering, work simplification, job evaluation, and industrial relations.

A NEW FOUR-YEAR bachelor's degree program, offering broadened studies in the humanities, while retaining sound instruction in the engineering fundamentals, and a fifth year of specialized graduate work have been adopted for the School of Engineering at North Carolina State College in a move designed to meet the changing needs of modernized industry and to provide students with thorough cultural backgrounds.

Since the large majority of students conclude their formal education at the bachelor's level, breadth of fundamental knowledge in the chosen field will be stressed rather than concentration on a specialty within that field. Forty-two hours of study in the humanities are required under the new plan.

STUDENTS AT OHIO STATE University are to have the benefit of a special safety engineering curriculum set up through the Ohio Industrial Commission working in cooperation with the university's industrial engineering department. Three commission members, specialists in industrial problems, will lecture without pay at the university, consult with students on engineering problems, and help map a safety engineering research program. The commission members who will be on the campus are Lester M. Merritt, a ceramic engineer and authority on dust hazards; Dr. Walter E. Obetz, M.D., a specialist in occupational disease prevention; and Rufus Schockey, an attorney specializing in the field of employer liability.

TEN SPONSORED GRADUATE fellowships with stipends ranging from $750 per year to $1,800 per year are available for 1947–1948, at the School of Engineering of Pennsylvania State College. These are open to students pursuing advanced work toward the M.S. or Ph.D. degrees in aeronautical engineering, electrical engineering, engineering mechanics or mechanical engineering. Four of these fellowships are open to graduates in physics. Also ten departmental graduate assistantships ($1,000 a year) and a number of full-time research assistantships are being offered. Requests for information or application forms should be sent immediately to H. P. Hammond, dean, School of Engineering, The Pennsylvania State College, State College, Pa.

OFF-STREET PARKING FACILITIES will be the subject of a research program initiated by the Yale University Bureau of Highway Traffic, New Haven, Conn., using funds provided by the Eno Foundation for Highway Traffic Control, Inc., of Saugatuck, Conn. The study will cover the design of off-street parking lots and garages, as they are affected by vehicle characteristics and the movement of traffic to and from adjoining streets. It is planned to make detailed studies of existing garages of various types and to determine the critical features which facilitate the rapid, efficient, and safe movement of vehicles in garages. Edmund R. Ricker, Jun. ASCE, a graduate of the Yale Bureau, has joined the staff and will devote full time to the study.

NEWS OF Engineers

Oren L. King has resigned as city manager of Montrose, Colo., to accept a position as the first city manager of Pendleton, Ore. Mr. King has been city manager of Montrose since 1942, except for the period between April 1944 and September 1945, when he was given a leave of absence to serve in the Army.

Robert C. Hunter, colonel, Army Corps of Engineers, is retiring from the Army after serving in the Corps of Engineers since 1917. During the war, Colonel Hunter was district engineer for the Army at Sacramento, Calif., and in 1945 was called to the Philippines to assist in the rehabilitation of water and electric supplies, road construction, and harbor installations. Upon his return to the United States, he was assigned to duty as district engineer at Los Angeles.

Charles O. Quade is now associated with Herbert M. Tatum and George W. Alexander in the engineering and architectural firm of Tatum, Alexander & Quade, with headquarters in Dallas, Tex.

Edward M. Dougherty, formerly with the Pittsburgh–Des Moines Steel Co., Pittsburgh, Pa., has accepted a position in the engineering department of the Southern Railroad, with headquarters in Knoxville, Tenn. During the war, Mr. Dougherty served in the Army Corps of Engineers.

Robert O. Davis was recently appointed division engineer in the newly formed Rocky Mountain Division, Topographic Branch, U.S. Geological Survey, with headquarters at Denver, Colo. Mr. Davis has been with the Geological Survey since 1929, except for a period of wartime service with the Army Air Force. He was discharged as a lieutenant colonel in April 1946.

Frederick A. Rodewald, captain, Army Sanitary Corps, is stationed at Okinawa, while serving a tour of overseas duty. Captain Rodewald was recently awarded the Army Commendation Ribbon for his work as sanitary engineer on temporary duty with the Headquarters of the Eighth Air Force during the period from January to April 1946. In this capacity, he directed the work of his unit "toward eradication of insects and sanitation of areas occupied by organizations of the Eighth Air Force."

John Roland Carr, until lately assistant editor in the Chicago office of *Engineering News-Record*, has been made an associate editor, with headquarters in the Cleveland, Ohio, regional office.

Herbert P. Winn has been transferred from the Pittsburgh District of the Corps of Engineers, to the Office of the Chief of Engineers, Washington, D.C., where he is in charge of the Utilization Branch. At Pittsburgh Mr. Winn was head of the Veterans' Administration Hospital, Construction Branch.

Carleton S. Proctor, New York City consultant and former ASCE Director, was awarded the honorary degree of doctor of engineering at the annual Alumni Day celebration at Princeton University. The citation accompanying Mr. Proctor's award referred to his service as Engineer Officer in both World Wars and as commanding officer of the Desert District of the Persian Gulf Command, in the recent war, and as chairman of the National Engineers Committee, which produced the Engineers' Plan for the Industrial Disarmament of Germany and Japan. He was also cited as an "outstanding authority on foundations and engineer on some of the world's largest bridges." At the same ceremonies, which climaxed the Princeton Bicentennial Celebration, the honorary degree of science was awarded to **Dr. Theodor von Karman,** director of the Guggenheim Aeronautical Laboratory at the California Institute of Technology and visiting professor at Columbia University. Dr. von Karman was cited as "consultant extraordinary to the aeronautical industry."

M. E. Boriss is now city engineer of Chattanooga, Tenn. He was recently released from the Army Corps of Engineers.

Fred E. Swineford has resigned as chief engineer of the Ohio State Highway Department Bureau of Construction to accept the position of engineer-director for Macadam Products, Inc., at Columbus, Ohio.

Elwyn E. Seelye has formed a partnership with his associates, **Albert L. Stevenson** and **Burnside R. Value,** to continue the New York consulting practice of Elwyn E. Seelye & Co. The new firm, to be known as Seelye, Stevenson & Value, will specialize in the structural design of buildings, airports, bridges, manufacturing plants, highways, tunnels, and hydroelectric plants.

Guy H. Elbin is now engineer in charge of construction for the Franklin County (Ohio) engineering department. He was previously chief bridge engineer for the Ohio State Highway Department.

James T. Voshell is retiring as division engineer of the Public Roads Administration at Chicago, after 40 years with the organization and its predecessor, the U.S. Bureau of Public Roads. **R. H. Harrison,** highway engineer in the Chicago office, has been appointed acting division engineer.

Charles M. Upham, engineer-director for the American Road Builders Association, Washington, D.C., recently received the Association's George S. Bartlett Award for "distinguished work in engineering in 1946." Presentation of the award took place at the forty-fourth annual banquet of the organization, which was held in Chicago. Before going to the American Road Builders Association in 1935, Mr. Upham had been chief engineer for the Delaware and North Carolina State Highway Commissions. He is chairman of the executive committee of the ASCE's Highway Division.

Charles M. Upham

Albion Davis has retired as chief hydraulic engineer of the Union Electric Co. of Missouri at St. Louis. Mr. Davis has worked in the field of river hydraulics and power for the past 33 years, having been connected with operation of the Keokuk (Iowa) plant on the Mississippi River since 1914, and of both that plant and the Bagnell plant in Missouri since 1931. He won the Norman Medal for his paper describing experiments on spillway discharge at the Keokuk Dam.

Robert E. Ellis, Jr., has been elected vice-president of the New York contracting firm, the Frederick Snare Corp. Mr. Ellis is in charge of the company's operations in Venezuela, with headquarters at Caracas.

William Chester Morse, since 1938 superintendent of water for the City of Seattle, Wash., has been reappointed to another term in that post.

James J. Doland, professor of civil engineering at the University of Illinois, will be in charge of a new research program on drainage of superhighways that the university has undertaken for the state and federal governments.

A. W. Keller recently returned from Bogota, Colombia, where he made a preliminary survey for a comprehensive plan for the city and a subdivision of the surrounding terrain. He is associated with **Ernest P. Goodrich,** New York consultant, on the project.

ASCE Members Assist Indian Government on Irrigation Project

Dr. Lorenz G. Straub, St. Anthony Falls Hydraulic Laboratory, University of Minnesota, is in Madras, India, assisting the government of that province in a preliminary investigation of an irrigation project on the Godavari River, with particular emphasis on an erosion problem developed by the proposed diversion of the river during construction. Estimated to cost $100,000,000, the project is to include a reservoir capable of storing 15,000,000 acre-ft, and a dam 7,000 ft long and 500 ft high, its base extending 200 ft below the stream bed.

Two other ASCE members engaged by the Madras provincial government to study the hydraulics and erosion problems involved, already have inspected the site. They are **John L. Savage,** Hon. M. ASCE, special consultant to the U.S. Bureau of Reclamation, Denver, Colo., and **Dr. Karl Terzaghi,** Professor of the Practice of Civil Engineering, Graduate School of Engineering, Harvard University, and winner of the 1946 Norman Medal. When he left New York for India by plane March 14, Dr. Straub expected to be in India a month. Upon his return to the United States, this American board of engineers will seek, through hydraulic model studies, a solution of the problem involved.

Charles Otto Gunther, professor of mathematics and ordnance engineering at Stevens Institute of Technology, was one of three recipients of Stevens Honor Awards at the dinner of the alumni association of the Institute, which was held in New York on March 7. A teacher of mathematics at Stevens for 47 years, Professor Gunther is the author of many technical and scientific articles and is widely known as an authority on ballistics. He served as an officer in the Ordnance Department of the Army in both World Wars.

Charles O. Gunther

William Kelly, of Buffalo, N.Y., is leaving for Berlin, where he will serve as chief of the public utility section of the industrial branch of the Office of Military Government. An authority on public utilities, Mr. Kelly recently retired as chairman of the Buffalo-Niagara Electric Corp. and president of the Buffalo, Niagara & Eastern Power Corp. He is an Honorary Member of the ASE.

N. T. Veatch, consulting engineer of Kansas City, Mo., has been elected president of the American Water Works Association for the year beginning July 1, 1947. **Linn H. Enslow,** editor of *Water Works and Sewerage,* has been elected vice-president, and **W. W. Brush,** editor of *Water Works Engineering,* treasurer. Another member of the ASCE, **Harry E. Jordan,** continues as secretary.

Jasper Gerardi, associate professor of engineering drawing at the University of Detroit, has been appointed acting assistant dean in the college of engineering.

T. B. Granger, who was recently released from the Army Corps of Engineers after five years of service, has become connected with the Dallas, Tex., firm of T. C. Forrest, Jr.

Frank A. Randall, Chicago consultant, has taken **Frank A. Randall, Jr.,** and **John D. Randall** into partnership with him under the firm name of Frank A. Randall & Sons.

Russell Van Nest Black, planning consultant of New Hope, Pa., is making a planning survey for the City-County Planning Committee at Winston-Salem, N.C.

Robert W. Rowen has been appointed vice-president in charge of engineering and research for the Nichols Engineering & Research Corp., New York City.

John E. Field has reestablished his consulting and supervising engineering practice in Denver, Colo. He was previously supervising engineer for the Defense Plant Corp., at Denver.

John R. West has opened a sales office for the Mosher Steel Co. at Lubbock, Tex. He is representing that organization in the west Texas area.

Andrew W. Rogers, Jr., is now an engineer for the Austin Road Co., with headquarters in Dallas, Tex. He was recently separated from the service after six years as a major in the Field Artillery.

Sinclair O. Harper, retired chief engineer, U.S. Bureau of Reclamation, Denver, Colo., and now a consulting engineer there, has been engaged by the Egyptian government to serve on a Board of Engineers studying bids recently received on hydroelectric power equipment and its installation at the famous Assuan Dam, 400 miles up the Nile from Cairo. Mr. Harper will serve with at least two other engineers on the board, one having already been engaged from Switzerland and another from Sweden. They are assisting the Egyptian government in its plans for development of 300,000 hp. Although Assuan Dam was completed as an irrigation and flood control reservoir in 1902, and its height has been increased twice since then, this is the first time the water impounded is to be used for power development.

Philip H. Carlin is now specification engineer for Smith, Hinchman & Grylls, Inc., of Detroit, Mich. He was formerly project analyst for the City Planning Commission of Philadelphia, Pa.

Joseph H. Gandolfo has retired from his position as structural engineer for the J. G. White Engineering Corp., of New York. His home address is 45 Church Street, Montclair, N.J.

Earl J. Reeder, previously chief traffic engineer for the National Safety Council, Chicago, Ill., is now director of the Miami (Fla.) Department of Traffic and Transportation.

Deceased

Ernest Samuel Alderman (Assoc. M. '17) assistant engineer for the Oklahoma State Highway Department, Oklahoma City, Okla., died on January 9. Mr. Alderman, who was 60, had been with the department since 1919. Earlier in his career he had been with the U.S. Department of Agriculture, and with the Bureau of Public Roads (now the Public Roads Administration) in Oklahoma City.

John Crosbie Brackenridge (M. '97) of Kew Gardens, N.Y., died in a New York City hospital on February 2. He was 82. An authority on transit matters, Mr. Brackenridge had been chief engineer and general manager of the old Brooklyn Rapid Transit Co., and from 1904 to 1906 was commissioner of public works for the Borough of Brooklyn. He was also a founder and vice-president and general manager of the Manhattan Bridge Three Cent Line. From 1908 until his retirement in 1933, Mr. Brackenridge had a consulting practice in New York.

Sumner Gowen (Assoc. M. '02) designing engineer for the Phoenix Bridge Co., Phoenixville, Pa., died on February 18. He was 73. Mr. Gowen had spent his entire career with the Phoenix Bridge Co., having gone there as draftsman soon after his graduation from Massachusetts Institute of Technology in 1897.

Edward Haupt (M. '28) retired civil engineer of Evanston, Ill., died on February 6, at the age of 77. Early in his career Mr. Haupt was with the Phoenix Iron Co., and Chicago representative of the Mt. Vernon Bridge Co. In 1905 he was one of the founders of the Strobel Construction Co., a Chicago contracting firm engaged in the construction of bridges and steel buildings, and for many years served as president of the company. Mr. Haupt had been president of the Chicago Engineers Club and of the Building Construction Employers' Association.

Edward Haupt

Albert Haskell Clough (Assoc. M. '42) explosive engineer for the Atlas Powder Co., San Francisco, Calif., died on May 12, 1946, according to word just received by the Society. Mr. Clough, who was 70, had been with the Atlas Powder Co. since 1915. Prior to that he had been employed as engineer and superintendent on the design, location, and construction of various hydroelectric projects, and had served as an engineer on the investigation of water power resources for the California State Board of Control.

Daniel Abram Dean (Assoc. M. '13) engineer for the Design Service Co., of Cleveland, Ohio, died suddenly on January 15 in Pittsburgh, Pa., where he had been assigned for work to the Blaw-Knox Corp. His age was 58. Mr. Dean had built and operated large oil refineries at Enid and Allen, Okla., and at one time was with the Vendome Tank Car Co., of Tulsa, Okla. During the recent war, he did research work in connection with the design and manufacture of refinery equipment for use overseas and in this country.

Edward Hall Faile (M. '30) retired consultant of Westport, Conn., died at his winter home at Hobe Sound, Fla., on February 21. He was 63. Mr. Faile had been chief engineer for the Adams Express Building Co., supervising engineer for the Oceanic Investing Co., and general manager of the National Magnesite Products Corp., all of New York. For some years, also, he maintained a consulting practice, his work including the design and construction of several New York skyscrapers, numerous reinforced concrete factories, and the Rhode Island state airport. During the first World War, he was resident engineer for the Emergency Fleet Corp., in charge of the construction of a submarine shipyard at Newark, N.J.

Robert Theodore Leipold (M. '22) of Washington, D. C., died there on February 9. Mr. Leipold, who was 70, was for a number of years in charge of design for the Pittsburgh division of the American Bridge Co. He had also been with the Milliken Brothers Co., of New York, and with the Pennsylvania Railroad Co., on the design of the Philadelphia improvements. More recently he had been designing engineer in the Bureau of Yards and Docks, engaged on the design of a large floating drydock for the repair of ships near battle areas.

Clement Clarence Williams (M. '18) consulting engineer of Madison, Wis., died there on February 20. Dr. Williams, who was 65, had spent most of his career in engineering teaching. He had been on the engineering faculties of the University of Colorado, the University of Kansas, and the University of Illinois, and dean of the University of Iowa engineering college. From 1935 to 1944 he was president of Lehigh University, resigning in the latter year to establish a general consulting practice in engineering and industrial education at Madison. Dr. Williams was the author of several engineering works, and had been president of the American Society for Engineering Education and a trustee of the Carnegie Foundation for the Advancement of Teaching. He recently became a Life Member of the ASCE.

C. C. Williams

Norman Bassett Gurley (M. '46) chief engineer for the Lando Coal Corp., Huntington, W.Va., died there suddenly on February 26, at the age of 56. From 1918 to 1924, Mr. Gurley had a private civil and mining engineering practice at Williamson, W.Va., and from 1924 to 1939 was chief engineer of the Red Jacket Coal Corp. From 1939 until 1946, when he joined the Lando Coal Corp., he was engineer and sales representative for the West Virginia Steel & Manufacturing Co. In the latter year, he was also named a member of the Huntington Sanitary Board, created to supervise construction of the city's proposed new sewer system.

Carlton Eugene Hunt (Affiliate '06) of Providence, R.I., died on February 9. Mr. Hunt, who was 80, spent his early career in railroad work and with the Providence Street Railway System. Beginning in 1902, he was for a number of years with the New York firm of Westinghouse, Church, Kerr & Co., as assistant to the chief engineer. From 1921 to 1931 he was cost engineer for the Dwight P. Robinson Co., Inc., and more recently he had been with United Engineers & Constructors, Inc., of Philadelphia.

Wayne Dickson Maxwell (M. '22) construction engineer of Greeley, Colo., died there on February 2, at the age of 65. Mr. Maxwell was in the engineering department of the City of Des Moines, Iowa, for most of the period from 1905 to 1913, and from the latter year to 1925 was county engineer for Sac County, Iowa. He then became secretary of the Associated Pennsylvania Constructors, at Harrisburg, Pa., resigning in 1934 to establish a civil engineering practice. He specialized in the construction of public works.

Allan Appleton Robbins (M. '04) president of the Robbins-Ripley Co., New York City engineering and contracting firm, died at his home in New York on February 17. He was 74. Early in his career Mr. Robbins was resident engineer on subway construction for the Interborough Rapid Transit Co., and from 1904 to 1909 principal assistant engineer for the New York & Long Island Railroad. He had been president of the Robbins-Ripley Co. since 1909. He was a veteran of the Spanish-American War.

Walter Lynes Smith (M. '22) retired engineer of St. Louis, Mo., died on January 29, at the age of 70. For some years Mr. Smith was in the office of the Engineer of Bridges for the Pennsylvania Lines west of Pittsburgh, and from 1920 until his retirement in 1942 he was bridge engineer for the Terminal Railroad Association of St. Louis. His work included the design and construction of movable bridges aggregating about two million dollars, and the reconstruction of the upper and lower decks of the Eads Bridge. On December 1, 1946, Mr. Smith became a Life Member of the ASCE.

Isaac Joshua Stander (M. '21) retired New York City consultant, died in Miami, Fla., on February 13, at the age of 75. Born in Riga, Latvia, Mr. Stander was educated in this country and spent his career here. For many years he was in the New York Department of Docks. He resigned in 1917 to establish a private engineering and contracting practice, specializing in waterfront and subway construction.

William Edward Schenck Strong (Assoc. M. '98) retired engineer of Englewood, N.J., died on February 24, at the age of 77. From 1917 until his retirement a few years ago Mr. Stander had a consulting practice in New York City. Earlier he was manager of the engineering department of the American Radiator Co. in Chicago.

Thomas Judson Wright Jr. (M. '36) retired engineer of Norfolk, Va., died at his home in Nansemond County, Virginia, on February 21. He was 60. Mr. Wright had been with the Norfolk & Western Railway and the Portsmouth (Va.) Board of Water Commissioners. In 1915 he became engineer for the Norfolk branch of the Richmond Cedar Works, and later served as manager. From 1937 until recently he was district manager of the Southern Pine Association at Norfolk.

Standards for California Highways Stress Safety

(*Continued from page 26*)

It is necessary that locations on all routes be permanently established as rapidly as possible and rights-of-way acquired far in advance of construction. Early acquisition often results in substantial financial savings, and tends to stabilize community development.

In order that the state expressway system recommended for California may accomplish its purpose of uninterrupted movement of traffic, adequate means must be provided for administrative authorities to overcome two situations:

First, immediately to negotiate and establish limited and controlled access on more recently constructed sections. Some highways that are recommended for addition to the state expressway system are being throttled by the growth of roadside business establishments too close to the right-of-way. If allowed to continue, this may require relocation of the road to permit safety and freedom of movement.

Second, to acquire rights-of-way on new sections with access rights denied or controlled without unduly delayed processes. This is essential to preserve the highways for their intended use.

Railroad Grade-Separation Structures

The highway-railroad grade-crossing problem is a transportation subject of wide popular interest because the spectacular nature of accidents at such locations has focused attention on physical deficiencies of the systems. This interest is reflected in federal appropriations for grade-crossing elimination.

Every driver is aware of the potential hazards at such crossings and has experienced irritating and often important time delays while waiting for movement of trains. The extent of the problem is indicated by the data in Table I, taken from the 1944 annual report of the California Railroad Commission.

TABLE I. NUMBER OF GRADE CROSSINGS AND GRADE SEPARATIONS IN CALIFORNIA

Location	Grade Crossings	Grade Separations
City streets (including urban state highways)	7,174	290
County roads	4,738	109
State highways	642	246
Federal roads	64	13
Doubtful jurisdiction	443	31
Total	13,061	749

Records of the California Motor Vehicle Department show that 144 deaths and 521 injuries occurred at grade crossings in the State during 1944. The Railroad Commission's figures are 224 deaths and 1,112 injuries, the difference probably lying in the fact that the Motor Vehicle Department compiles statistics only on accidents involving motor vehicles. Thus grade-crossing accidents accounted for 5.3 percent of all fatal motor-vehicle accidents in the state, and 1.95 percent of all reported motor accidents.

In 1944, California had 11 percent of the nation's motor-vehicle fatalities, but only 8 percent of the grade-crossing deaths. The nation averages 7.8 fatal grade-crossing accidents per billion vehicle miles of travel, while the California average is 7.3, indicating that this state has made progress toward holding this type of accident to a minimum. However, the ultimate desirable safety record has by no means been achieved.

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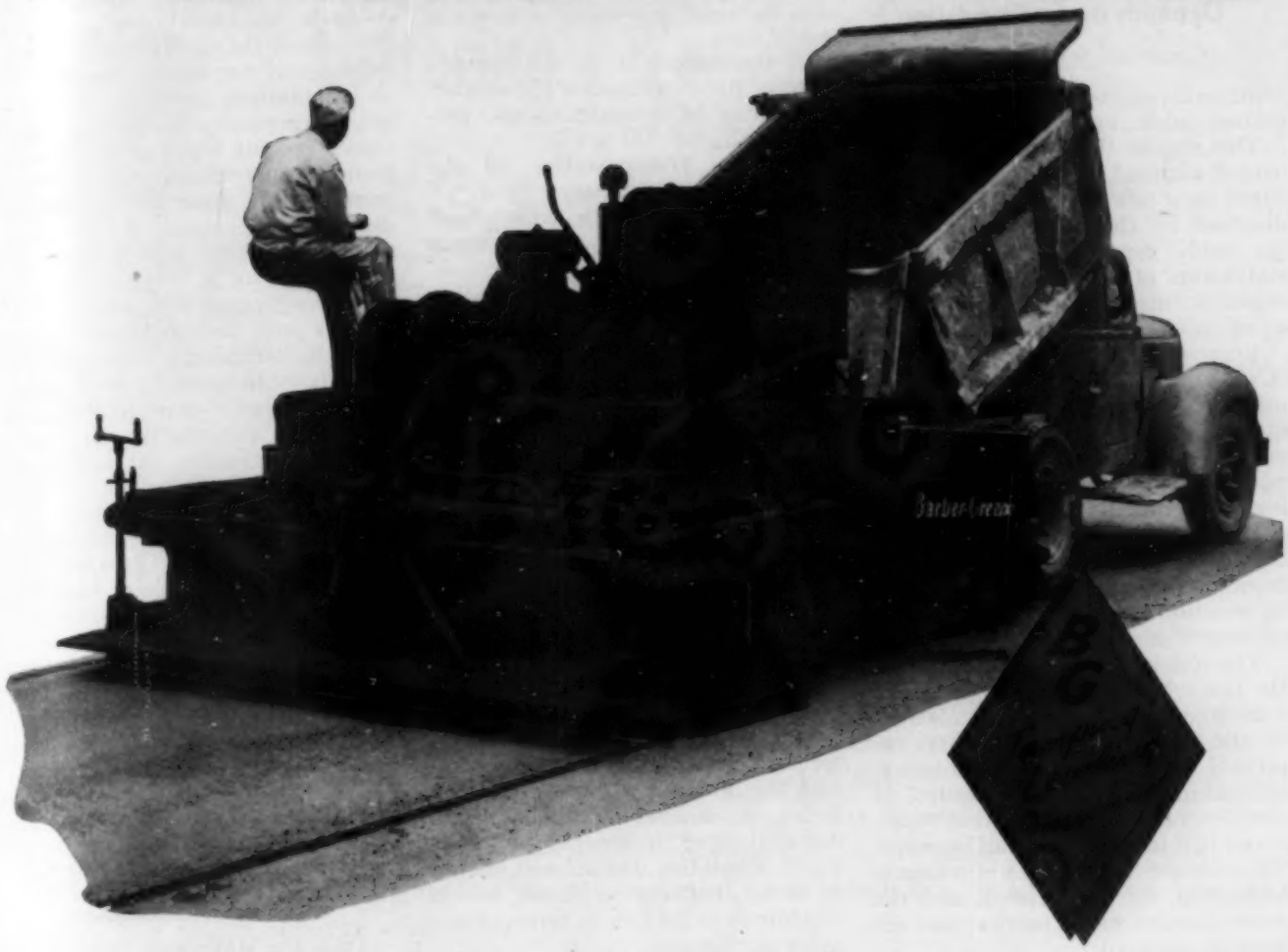

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In addition to accidents, time losses and inconvenience resulting from the stopping of highway traffic by movement of trains constitute major reasons for eliminating grade crossings.

Economic Welfare of Nation Depends on Transportation

(*Continued from page 21*)

transportation, to the using and investing public, and to labor.

This step in the formulation of an overall national transportation policy based on a new set of conditions was disclosed by the committee in making public reports which contained statements of about 500 companies, organizations and individuals interested in all forms of transportation.

Representative Clarence F. Lea (California), the committee chairman, in describing the committee's inquiry as the first step toward adjusting transportation legislation and administrative control, said the hearings will give all interested parties a chance to be heard and will give the committee opportunity for cross-examination, which is not possible when information is obtained on the basis of written statements alone.

The committee report, prepared by the Lea subcommittee with the aid of consultants, said that representatives of the transportation industry expressed divergent views on common ownership, operation and control of carriers of the same or different types, about half in favor and half opposed. The railroads are in favor of common ownership, the report said, and the water carriers, motor carriers and airlines are opposed.

Either legislative action is soon needed to settle conclusively all uncertainties, the committee concluded, or a definite decision should be reached that these are and can be solved without legislative action at this time. These problems were outlined as follows:

1. Whether the regulation of all common-carrier forms of transportation should be centralized in the Interstate Commerce Commission either as presently organized or under a reorganization.
2. The wisdom of control and operation of one form of carrier by another and, if permitted at all, under what circumstances and conditions. This is familiarly known as integration.
3. Whether, under present competitive conditions, the federal government is warranted in continuing the promotion of one or more types of common carriers but not of others, and in granting aid to certain types but not to others, except on a self-liquidating basis.
4. Exemption of common carriers from the application of the anti-trust statutes where the activities in question are under the supervision of the federal regulatory agency.
5. Whether the present regulatory bodies, working within the framework of existing statutory authority, can be deemed to have sufficient scope and to have developed administrative practices adequate to deal with the rapid movements of economic events.

In conclusion, it is the writer's opinion that coordination of transportation can be brought about, provided we:

1. Keep transportation in the hands of private industry.
2. Administer with equity and sound economy the public funds spent in transportation.
3. Cause the component branches of transportation to stand on their own feet.
4. Let the chips fall where they may.

Engineers Ask Congress for Labor Law Amendments

(*Continued from page 44*)

same standard of measurement for services of professional men and non-professional men is not in the public interest. The output of professional employees cannot be standardized as can that of manual and skilled labor. It cannot be measured in terms such as the number of brick a man should lay in a given number of hours, the number of cubic yards of dirt that should be moved, the square yards of painting, the amount of type to be set, bolts to be placed, feet of conduit to be laid, or in terms of any other similar unit.

"The production output of the professional man is largely that of his mind, while that of the non-professional depends largely on his manual skill and dexterity. No law by which professional employees and those engaged in routine, mental, mechanical and physical work must conform to the same regulatory pattern is a just law. It is unjust alike to the laborer, the non-professional white-collar worker, to the professional man, to their employers and to society.

"Although professional employees have found themselves mixed up in collective bargaining problems generally without desire on their part, and frequently in spite of their protests, we accept the principle of collective bargaining as a right of all employees, professional and non-professional. We do not believe that any professional employee should be required to belong to any organization as a condition governing his employment."

Here the statement turned to the enigma created for engineers by the forced grouping of professional and non-professional employees:

"The background, education, training and work interests of professional employees and non-professional employees are inherently divergent. It is futile to expect that a *forced* grouping of the professional and non-professional employees in any plant or organization could possibly form an 'appropriate bargaining unit.' Under present law and its administration, such plainly inappropriate groupings are made and, by fiat, are declared appropriate. We do not consider this to have been the intent of Congress.

"Some groups of professional employees have been recognized as appropriate bargaining units under existing laws, but usually such recognition has been accomplished only after long and costly controversy, entailing litigation and appeal and fundamental disturbance of employer-employee relationships. Frequently, however, professional employees have been grouped arbitrarily in heterogeneous bargaining units. In such cases the professional employees are usually a small minority in a large bargaining unit or trade union local, the majority of whose members have no community of thought or interest with professional employees.

"We believe that the law should be made so clear and explicit with regard to this matter as to eliminate the possibility of such groupings."

Three Points Recommended

Then the statement recommended inclusion of "three specific points of fundamental importance in any legislation which establishes standards for collective bargaining between employees and employer." These points, first adopted by the ASCE Board of Direction (CIVIL ENGINEERING for November 1946, page 511), and later declared by Engineers Joint Council to represent the consensus of the membership of its five constituent societies (CIVIL ENGINEERING for January 1947, page 46), were stated by the panel as follows:

"Any group of professional employees, who have a community of interest and who wish to bargain collectively, should be guaranteed the right to form and administer their own bargaining unit and be permitted free choice of their representatives to negotiate with their employer.

"No professional employee, or group of professional employees, de-

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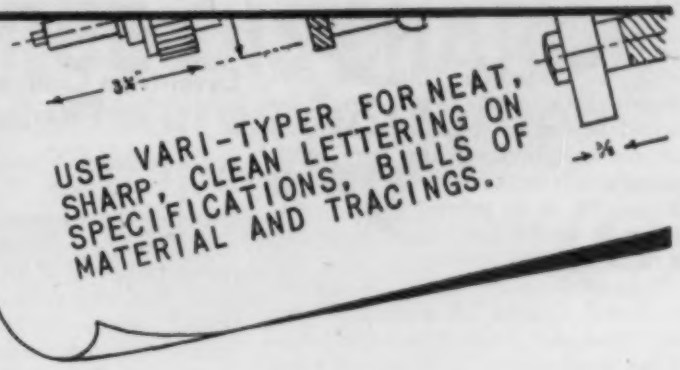

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siring to undertake collective bargaining with an employer, should be should be forced to affiliate with, or become members of, any bargaining group which includes non-professional employees, or to submit to representation by such a heterogeneous group or its designated agents.

"No professional employee should be forced, against his desires, to join any labor organization as a condition of his employment or to sacrifice his right to individual, personal relations with his employer in matters of employment conditions."

The representatives of the engineering profession advocated "legislation which would cover these three points, and cover them without possibility of contrary interpretation," in order to "satisfy one of the avowed purposes of the present National Labor Relations Act."

Avowed Purpose of Act Not Achieved

"It is proclaimed in Section 1 of the Act," the statement declared, "that one of its purposes is: 'to protect the exercise by workers of full freedom of association, self-organization, and designation of representatives of their own choosing, for the purpose of negotiating the terms and conditions of their employment or other mutual aid and protection.'

"So far as professional employees are concerned, administration of the Wagner Act often is completely contrary to the avowed purpose above quoted. The 'freedom' of association and choice so properly proclaimed in the Act frequently proves in fact to be but an empty promise to professional employees."

The presentation was concluded with citation of section, clause and paragraph changes in the two pending bills which would rectify the conditions deplored by the engineers, and the declaration:

"Beyond question, enactment of these amendments would materially promote harmonious relations between management and professional employees. Such action would minimize the costly and disruptive turmoil which has existed in professional ranks with resulting loss of productive service and effective industrial relations. We see nothing in them to which exception can be taken by anyone who has at heart the best interest of this tremendously important group. We respectfully request your Committee to include these provisions in whatever legislation for amending the National Labor Relations Act may be developed as the result of the current hearings."

Level-Men Cautioned on "Waving the Rod"

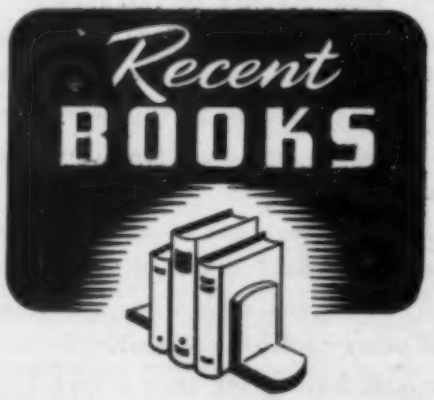
(*Continued from page 48*)

Using the expression $E = A \sin \alpha + R \cos \alpha - R$, we find the maximum values of E to be as shown in Col. 3 of the table. However, the actual errors in the rod readings under the assumed conditions are $E/\cos \alpha$ and are tabulated in Col. 4 of the table.

Neglecting the upper part of the table, since no one would be likely to wave a rod when reading within a foot of the bottom of it, we see that even when reading at 10 ft or higher on the rod, the "false minimum" introduces an error in the reading of about 0.001 ft, and if the rod is waved when reading as far down as the 3-ft mark this error is about 0.004 ft.

This is a matter that should be understood and kept in mind by all levelmen engaged on work on which an attempt is made to secure any real accuracy.

It is rather obvious that the best method of obtaining correct readings is to mount a circular level on the rod, keep it in adjustment, and use it to keep the rod vertical while readings are being made.



ADVANCED MATHEMATICS FOR ENGINEERS, 2 ed. By H. W. Reddick and F. H. Miller. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 508 pp., diagrs., tables, 8½×5½ in., cloth, $5. Assuming a knowledge of mathematics through the calculus, this book begins with the theory and standard methods of manipulation of ordinary differential equations. Succeeding chapters deal with various special functions, integrals, series and equations, vector analysis, probability, and the operational calculus. To emphasize physical applications, problems are presented, with each principal topic relating to the main fields of engineering. An appendix gives a brief discussion of dimensional analysis and systems of physical units.

ANALYTIC GEOMETRY AND CALCULUS. By J. F. Randolph and M. Kac. The Macmillan Company, New York, 1946. 642 pp., diagrs., tables, 9½×6 in., cloth, $4.75. In this book analytic geometry and calculus are treated together in such a way that each complements the other. The object is to provide an early presentation of the concepts of calculus as an aid in other technical subjects. By using two sizes of type and different groups of problems, the authors distinguish the sections suitable for the average college class from those intended for more extended study, thus widening the usefulness of the book. Answers are provided for selected problems.

LONDON BUILDING LAW for the use of Architects, Surveyors, and Students. By H. R. Chanter. B. T. Batsford Ltd., London, 1946. 358 pp., diagrs., tables, 9×6 in., cloth, 21s. Intended as an introduction and guide to the various enactments and bylaws which affect building in London, this book provides a comprehensive digest of the essential requirements in the actual construction of buildings in that city. The book includes definitions and interpretations, design tables and calculations, and a historical review of London building law, in addition to a résumé of definite regulations on construction practice. Miscellaneous topics dealt with include illumination, noise, drainage, smoke, advertising signs, streets, area planning, etc.

OIL FOR VICTORY, the Story of Petroleum in War and Peace by the Editors of *Look*. McGraw-Hill Book Company (Whittlesey House Division), New York, 1946. 287 pp., illus., 10×6½ in., cloth, $3.50. This story of the petroleum industry in the war is essentially the story of the people, from the Chinese coolie on the Burma Road to Petroleum Coordinator Ickes, who contributed to the final success. The work of the oil hunters, the production crews, the refinery workers, the research technicians, and the road, rail, air and water transportation is described in text and pictures. From "Big Inch" to U-boat raids, the high lights are given.

PLANNING RECOMMENDATIONS FOR THE WASHINGTON SQUARE AREA. Prepared for the Washington Square Association. By A. C. Holden. Washington Square Association, New York (65 Fifth Ave.), 1946. 101 pp., illus., maps, charts, tables, 11 × 8½ in., paper, $1.50. The recommendations contained in this report have to do with transportation, housing, business locations, parks, and the preservation of public buildings. A physical analysis of the area, with numerous descriptive maps and plans, comprises the second section, followed by a functional analysis and synthesis of the factors involved as presented in the first two sections. The whole offers a typical example of an over-all planning job.

SCIENCE REMAKES OUR WORLD, Rev. ed. By J. Stokley. Ives Washburn, New York (29 West 57th St.), 1946. 318 pp., illus., diagrs., 8¾ × 5¾ in., cloth, $3.50. In simple, non-technical terms the author describes the scientific developments of recent years and shows how they affect our everyday life as well as the technical fields involved. The wide range of topics includes plastics, chemurgy, color photography, television, sulfa drugs and penicillin, jet propulsion, radar, and rockets. An insight into the future is provided in the material on helicopters, light that flows around corners, three-dimensional movies, atomic power, etc.

STANDARD MILITARY RAILWAY BRIDGES. By F. S. Bond. Railway Gazette, London, 1946. 26 pp., illus., diagrs., maps, tables, 11¼ × 8½ in., paper, 5s. This group of articles, reprinted from various issues of the Railway Gazette, gives descriptions of the different types of bridges designed for rapid erection in the field by the Allied Forces, and of the various methods employed in such erection. The types are as follows: Unit construction railway bridge; standard through-truss bridges; Everall Sectional Truss Bridge; 40-ft spans and under; examples of American practice.

SURVEYING: THEORY AND PRACTICE. By J. C. Tracy. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 1279 pp., illus., diagrs., charts, tables, 7¾×4¾ in., fabrikoid $7.50. Each branch of field work, as covered in Part I, is treated under three heads: The use of the instrument; the general method of procedure; the practical details of the field work. Part II explains general methods of office work, both drafting and computation, with emphasis on systematic procedure. Part III is a critical study of the construction and adjustment of instruments, with directions and suggestions for standardizing tapes. Part IV furnishes a working knowledge of requirements and procedures for special types of surveys, such as horizontal control surveys, aerial photographic surveys, etc.

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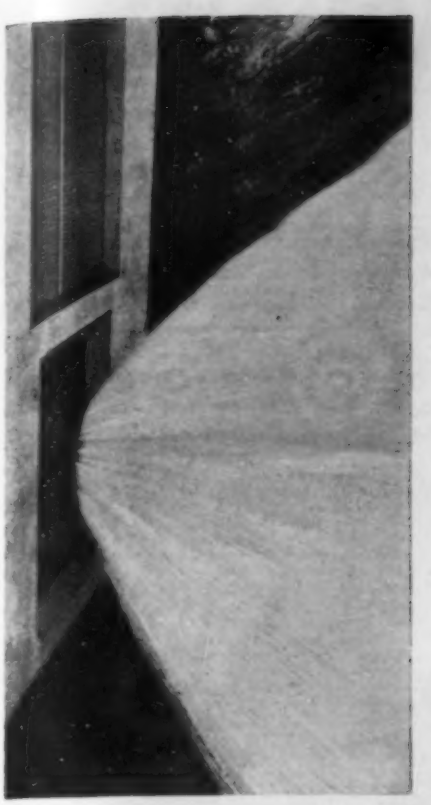

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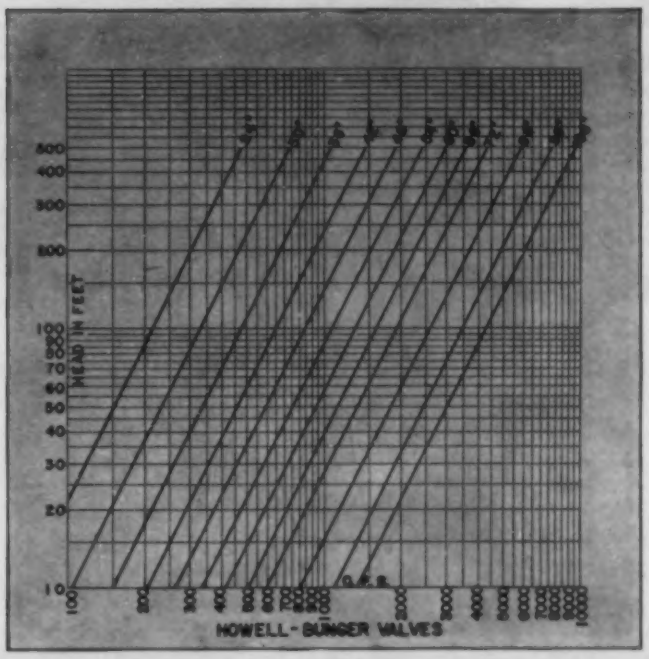

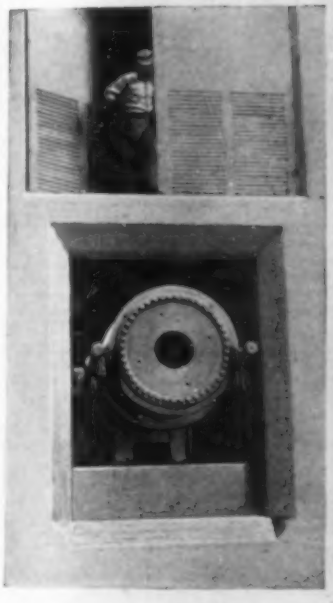

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Current Periodical Literature

Abstracts of articles on civil engineering subjects from other periodicals. Articles indexed are on file in the Engineering Societies Library, 29 West 39th St., New York 18, N. Y., from which photoprints or technical translations are available at cost, plus postage.

BRIDGES

STEEL TRUSS, AUSTRALIA. New Hawkesbury River Bridge. *Ry. Gas.*, vol. 85, no. 7, Aug. 16, 1946, pp. 187–189. Notes on defects of old structure spanning Hawkesbury River on New South Wales Government Railways, and design and construction of new bridge. Design embodies two spans each 445 ft 8 in. long and weighing 1,650 tons; four 347-ft 6-in. spans each weighing 1,040 tons; two 147-ft spans each of 260 tons; and two 75-ft reinforced-concrete arched approach spans. Length of structure is 2,764 ft, and total weight of steelwork is 7,980 tons.

BUILDINGS

BUILDING MATERIALS. New Ideas for Building Advanced to Hasten End of Housing Crisis. *Eng. News-Rec.*, vol. 137, no. 16, Oct. 17, 1946, pp. 534–536. Among most promising prospects being studied by National Housing Agency are structural concretes weighing about 50 lb per cu ft or less, thin metal sheets bonded to core of nonscarce material, wall and floor panels made of waste products, as well as miscellaneous equipment, such as special windows, knock-down door jambs, and combination wall bases and conduits.

HOUSES, PREFABRICATED. LeTourneau's Method for Building Concrete Houses. *Pac. Bldr. & Engr.*, vol. 52, no. 10, Oct. 1946, pp. 56–55 and 78. Procedure of erecting monolithically cast houses by means of Tournalayer is described step by step with aid of illustrations.

ROOF TRUSSES, REPAIR. Timber Trusses of Cathedral Roof Supported by Outside Cantilever Beams. *Eng. News-Rec.*, vol. 137, no. 22, Nov. 28, 1946, pp. 720–721. Illustrated report on repair and reinforcement of deteriorated timber trusses of St. Patrick's Cathedral in New York City; permanent repair was effected by putting structural steel frame at rotted ends.

WELDED STEEL STRUCTURES. Welded Frame Building Designed for Heavy Loads, M. Falk. *Eng. News-Rec.*, vol. 137, no. 20, Nov. 14, 1946, pp. 640–642. Three-story building in Fresno, Calif., was designed for heavy loads as all-welded steel structure; saving in amount of steel realized as compared with ordinary steel design; joint details are illustrated.

CITY AND REGIONAL PLANNING

CANADA. Regina and Stratford Have 30-Year Program of Civic Development, E. G. Faludi. *Roads & Bridges*, vol. 84, no. 11, Nov. 1946, pp. 66–69, 108, 110. Plans for civic development of Regina, Sask., and Stratford, Ont., over period of next 30 years; architectural drawings and models show plans for housing, business and industrial areas, and parking spaces.

LONDON, ENGLAND. Engineering Aspects of London Traffic Problems. *Engineering*, vol. 162, no. 4210, Sept. 20, 1946, pp. 277–278. Editorial comment on conference on London Traffic and London Plan, organized by Engineering Section of British Association; it is generally agreed that some reconstruction of both railways and roads is necessary.

ONTARIO. Street Improvements Included in 30-Year Plan for Development of Peterborough. *Roads & Bridges*, vol. 85, no. 1, Jan. 1947, pp. 48–52 and 78. Illustrations and discussion of master plan designed for long-range development of city of Peterborough, Ont.

CONCRETE

CONSTRUCTION, PRESTRESSING. Analysis and Design of Elementary Prestressed Concrete Members, H. Schorer. *Am. Concrete Inst.—J.*, vol. 18, no. 1, Sept. 1946, pp. 49–87. Outline of analysis and design of prestressed concrete beams, columns, ties, etc. Analytical expressions are simplified by means of convenient ratios, which define sectional shape, effective steel prestress and concrete fiber stress. Theory applied to numerical examples. Bibliography.

CONSTRUCTION, VIBRATING. Vibratory Paving Tube Tames Harsh Concrete. *Construction Methods*, vol. 28, no. 10, Oct. 1946, pp. 85–86. At Barksdale Field, Shreveport, La., vibratory paving tube successfully handled 126,000 sq yd of harsh concrete from 11 to 16 in. thick for taxiways and aprons; illustrated report on procedure.

DRYDOCKS, FLOATING. Floating Drydocks in Reinforced Concrete. *Concrete & Constr. Eng.*, vol. 41, no. 10, Oct. 1946, pp. 290–293. Illustrated description of reinforced-concrete floating drydocks at San Pedro, Calif.; data on construction and concrete placing.

MIXING. Plant for High Output of High-Grade Concrete, R. Struthers. *Concrete & Constr. Eng.*, vol. 41, no. 10, Oct. 1946, pp. 273–279. Illustrated description of concrete batching and mixing plant for daily output of 1,000 cu yd. General layout, data on material-handling equipment, concrete placing and strength.

PRESTRESSING. Cements with Controlled Expansions and Their Applications to Prestressed Concrete, H. Lossier. *Structural Engr.*, vol. 24, no. 10, Oct. 1946, pp. 505–534. Author tried to produce prestressing by swelling of concrete and to utilize expansive force either for tensioning reinforcements or in any other way. Data on expansive cements used for this purpose and discussion of their properties. Illustrated description of tests and application of expanding cements to underpinning, arches, repair of bridges, piles, water conduits, surfacing of roads and runways.

FOUNDATIONS

CONCRETE. Sheet Piles Cast on Concrete Platform for Kansas City Flood Wall. *Construction Methods*, vol. 28, no. 9, Sept. 1946, pp. 96–99. Piles are cast on oiled concrete platform within sectional steel forms that are easily set and stripped. Sheet piles are 10 in. thick, 30 in. wide, and 16 ft long, cut at one lower corner to form half-taper driving point. Data on construction equipment.

EXCAVATING MACHINERY. Heavy Rock Excavation in Kentucky Hauled with Earth-Moving Scrapers. *Eng. News-Rec.*, vol. 137, no. 12, Sept. 19, 1946, pp. 384–385. Conventional earth-moving scrapers move 75 percent of heavy rock and earth excavation on highway relocation project south of Camp Nelson, Ky.; data on mechanical equipment, operation, and costs.

PILE. Stuyvesant Town Project Is Supported on Spiral Corrugated Pipe Piles, F. L. Jenkins. *Highway Mag.*, vol. 37, Sept. 1946, pp. 186–187. Illustrated report on Armco Hel-Cor pile shells which have been employed for foundation of Metropolitan Life Stuyvesant Town housing project, N.Y.

SIPHONS. Foundation Displacements Along Melheur River Siphon as Effected by Swelling Shales, R. C. Mielenz and C. J. Okeson. *Economic Geology*, vol. 41, no. 3, May 1946, pp. 266–281. Malheur River Siphon, of Owhyee Project, comprises 21,976 ft of 80-in. welded steel pipe and 1,020 ft of 78-in. precast, reinforced concrete pipe, completed in 1935. Within three years supports of steel pipe showed severe distress in section lying north of Malheur River, 10 percent of total length of siphon. Field and laboratory studies show that displacements are due to expansion of bentonitic shales and claystones of Idaho formation.

SOILS, CONSOLIDATION. Wellpoint Dewatering System, R. G. Attwood. *Junior Instn. Engrs.—J.*, vol. 56, no. 9, June 1946, pp. 221–230. Method is described of dealing with excavations for trenches or foundations affected by "running sand." Well-point system involves use of perforated pipe assembly sunk into moist ground and connected to pumps which extract water therefrom. Installation of dewatering systems.

MATERIALS TESTING

AIRPORT RUNWAYS. Effect of Frost Conditions on Load-Carrying Capacity of Pavements. *Pub. Works*, vol. 77, no. 7, July 1946, pp. 33–34. Report on tests at Selfridge Field, Mich., to determine effect of frost on load-carrying capacity of airport pavements and of subsurface drainage conditions.

CEMENT. Cement Investigations for Boulder Dam—Results of Tests on Mortars Up to Age of 10 Years, R. E. Davis, W. C. Hanna, and E. H. Brown. *Am. Concrete Inst.—J.*, vol. 18, no. 1, Sept. 1946, pp. 21–48. Report on tests with cement and mortar employed for Boulder Dam; data on strength, volume changes and sulphate resistance. For both wet and dry storage conditions, factors are given which indicate contribution of four major cement constituents to strength and volume changes.

CONCRETE, AIR ENTRAINMENT. Stewart Field Demonstrates Value of Air Entrainment. *Concrete*, vol. 54, no. 10, Oct. 1946, pp. 8–9, 30. Air-entrained concrete pavement of Stewart airfield at West Point has resisted perfectly several vigorous winters and heavy wartime traffic. Data on aggregates, mixture, design, tests, and construction equipment.

CONCRETE, PERMEABILITY. Notes on Test of Permeation of Concretes by Gasoline Vapor, R. L. Blaine. *Concrete*, vol. 54, no. 10, Oct. 1946, pp. 3–7. Study of gasoline-vapor permeation of concrete; data on test specimens, testing procedure and effect of coatings; description of apparatus developed for measuring loss of gasoline in form of vapor which permeates concrete. Bibliography.

SOILS. Sampler for Hard-to-Hold Soils. *Eng. News-Rec.*, vol. 137, no. 12, Sept. 19, 1946, pp. 366–367. Illustrated description of "Denison" sampler, which is of double-barrel design with inner barrel free to move independently of outer barrel. It is used to obtain undisturbed samples of all types of overburden materials except gravel; Bureau of Reclamation has used it on dam-site investigations.

SOILS. Tests for Embankment Density, O. G. Goldman. *Western Construction News*, vol. 21, no. 9, Sept. 1946, pp. 106–108. Description of laboratory and field methods of securing best density of soil used for embankment; methods of determining optimum moisture content of soil; data on equipment used for tests.

PORTS AND MARITIME STRUCTURES

DOCKS, MOORING EQUIPMENT. Steel Tripod Braces Composite Mooring Dolphin. *Construction Methods*, vol. 28, no. 10, Oct. 1946, pp. 82–83. Illustrated description of steel and timber-pile mooring dolphins at Staten Island, N.Y.; steel pile tripods served as main frames. Data on construction.

GRAVEL. Filling Need in Michigan with Stabilized Gravel Roads, J. G. Schaub. *Better Roads*, vol. 16, no. 9, Sept. 1946, pp. 35–36, 38, and 40. Carefully graded aggregate and binder soil produces bases and surfaces of Michigan roads that have satisfactory stability under combined action of traffic and weather. Higher initial cost is offset by lower maintenance cost.

NEW YORK. Port of New York Authority. *Traffic Eng.*, vol. 16, no. 10, July 1946, pp. 397–403. Notes on organization and development; transportation facilities; railroad, grain and truck terminals; proposed bus terminal; air transportation; financing. All Port Authority projects must operate on self-supporting basis.

ROADS AND STREETS

HAUL ROADS, MAINTENANCE AND REPAIR. Good Haul Roads Make Good Sense, R. P. Nichols. *Construction Methods*, vol. 28, no. 10, Oct. 1946, pp. 92–93. Discussion of necessity of keeping haul roads smooth and compacted; otherwise rubber-tired scraper units cannot maintain maximum speed. Study revealed economies of production and costs on good roads as compared to those on poor roads; difference increases with increasing haul distances.

HIGHWAY SYSTEMS, BRITISH COLUMBIA. Hope-Princeton Road, H. C. Anderson. *Highway Mag.*, vol. 37, Sept. 1946, pp. 183–185. Illustrated report on Hope-Princeton mountain road through Manning Park in southern British Columbia, providing minimum width, exclusive of drainage ditches, of 30 ft. Road bed is to be surfaced with crushed gravel, overlying base of select crushing material from 6–12 in. Bridge structures are being constructed of steel and concrete and drainage culverts are also to be permanent type.

HIGHWAY SYSTEMS, CALIFORNIA. Limited-Access Postwar Project in District X Nearing Completion, M. C. Fosgate. *Calif. Highways & Pub. Works*, vol. 24, nos. 9–10, Sept.-Oct. 1946, pp. 19–20. Illustrated report on road construction nearing completion in San Joaquin County, Calif. Section of road now being improved was closed on account of San Joaquin River flood. Two bridges included in project.

HIGHWAY SYSTEMS, NEW YORK. New York Builds Thruway Route, H. O. Schermerhorn. *Better Roads*, vol. 16, no. 9, Sept. 1946, pp. 21–22, and 34. Illustrated report on highway which will make it possible to drive from Atlantic Ocean to Great Lakes without stop, thus spanning state's most densely populated and highly industrialized areas. Discussion of technical and economic significance of thruway.

HIGHWAY SYSTEMS OF THE FUTURE. Highways of Future, H. S. Fairbank. *Highway Mag.*, vol. 37, Sept. 1946, pp. 172–175. Future highways will differ from those of past mainly in better adjustment of design and capacity to character of usage. Reference is made to report by National Interregional Highway Committee to Congress in 1944. Discussion of requirements of highway standards concerning land width, signs and signals, and strength of pavement. Highway overpass near Arlington, Va., expressway in Chicago, traffic interchange for end of bridge at Portland, Ore., and parkway in South Pasadena, Calif., illustrated.

MAINE, CONSTRUCTION. Dirt Flies on Maine Turnpike. *Construction Methods*, vol. 28, no. 10, Oct. 1946, pp. 78–81, 165–166, 168. Illustrated report on construction of, and mechanical equipment used for, 4-lane 44-mile superhighway being built by Maine Turnpike Authority between Kittery and Portland.

MODERNIZING. Modernizing Illinois Route U.S. 66, W. W. Polk. *Traffic Eng.*, vol. 16, no.

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10, July 1946, pp. 390–394. Commentary on modernization plans for 290-mile highway between Chicago and St. Louis.

ROAD MATERIALS, BITUMINOUS. Some Bituminous Concrete Difficulties and Their Solutions. L. Burgess. *Crushed Stone J.*, vol. 21, no. 3, Sept. 1946, pp. 15–18. Practical suggestions for building bituminous concrete pavements. Discussion of old macadam as base, construction practices, mix design and essentials for durability.

SIZE DETERMINATION. Rising Mains—Most Economic Diameter, D. B. Smith. *Instn. Civ. Engrs.—J.*, vol. 26, no. 8, Oct. 1946, pp. 534–536. Computation of diameter of rising main into which water is delivered by electrically operated pump and then discharged into service reservoir. Paper deals only with pipes of approximately 4-in. to at most 18-in. diam.

WATER PUMPING PLANTS

CENTRIFUGAL, SELECTION. Selecting Deep-Well Centrifugal Pumps, A. O. Fabrin. *Southern Power & Industry*, vol. 64, no. 5, May 1946, pp. 46–51, 73. Referring to pumps used in connection with water supply from wells, article tells how pump size and blade type should influence selection of proper pump to do particular job. Charts indicate pump sizes and characteristics. Design calculations.

MAINTENANCE AND REPAIR. Renewal and Extension of Pumping Machinery for Metropolitan Water Board, M. R. James. *Instn. Civ. Engrs.—J.*, vol. 26, no. 8, Oct. 1946, pp. 432–469, (discussion) 469–483. Illustrated report on work carried out by Metropolitan Water Board, in installing new and economic pumping machinery, thus meeting increasing demands of metropolis for water.

WATER RESOURCES

CALIFORNIA. Sacramento-San Joaquin Water Supervision for Year 1945. *Calif. Dept. Pub. Works—Div. Water Resources—Report*, June 1946, 158 pp., 6 supp. sheets. Report on activities in valley-floor areas along Sacramento and San Joaquin river system; they include measurements of stream flow and water diversion, records of use, returned water for possible reuse, irrigated acreages and hydrographic activities. Results of observations listed in tables, charts, and maps.

DISTRIBUTION SYSTEMS, Algiers. Water Supply of Algiers and Its Environs, M. Raineau, *Water & Eng.*, vol. 49, no. 607, Sept. 1946, pp. 501–503. Illustrated description of water supply of Algiers now under construction. Water sources are artesian wells and dam which will impound river water.

MILITARY ENGINEERING. Enemy Water Supply Equipment, C. W. Karstens. *Am. Water Works Assn.—J.*, vol. 38, no. 8, Aug. 1946, pp. 959–968. Data on German and Japanese army water supplies, equipment, filters, chemical-warfare counter measures, and small Japanese units. In general, quality of water produced by both German and Japanese purification equipment is reported to be excellent.

MILITARY ENGINEERING. Water Supply in Middle East Campaigns, F. W. Shotton. *Water & Water Eng.*, vol. 49, nos. 607, 608: Sept. 1946, pp. 477–486; Oct., pp. 529–540. Report on water supplies adjacent to Cairo-Alexandria desert road and desert between Nile Delta and Suez Canal, data on hydrological and geological conditions, discussion of availability of water for irrigation purposes along road, presentation of water analyses, and discussion of water quality.

WATER TREATMENT

CHLORINATION. Experience with Break-Point Chlorination in Connecticut, F. O. A. Almquist. *New England Water Works Assn.—J.*, vol. 60, no. 3, Sept. 1946, pp. 269–281. Discussion of break-point chlorination. Inspections of Connecticut public water supplies revealed that bacteriological improvements by means of break-point chlorination are superior to those of taste and odor. Practical aspects in operation.

CHLORINATION. Recording Residual Chlorine, J. R. Baylis, H. H. Gerstein, and K. E. Damann. *Am. Water Works Assn.—J.*, vol. 38, no. 9, Sept. 1946, pp. 1057–1063. Illustrated description of residual chlorine recorder composed of cell and Micromax recorder. Discussion of factors influencing magnitude of current flowing through cell, such as electrode deterioration, temperature, hydrogen-ion concentration and combined chlorine.

FILTRATION PLANTS, CHICAGO. Chicago's South District Filtration Plant Nears Completion, W. W. DeBerard, F. G. Gordon and J. R. Baylis. *West. Soc. Engrs.—J.*, vol. 51, no. 3, Sept. 1946, Part 1, pp. 120–135. Illustrated description of design, construction and partial operation of South District Filtration Plant in Chicago, Ill.

FILTRATION PLANTS, LEICESTER, MASS. Slow Sand Filters are Not Yet Obsolete, W. S. Mariner. *Water Works Eng.*, vol. 99, no. 18, Sept. 4, 1946, pp. 1056 and 1076. Report on slow-sand filter plant now under construction at Leicester, Mass.; discussion of considerations that led to choice of this type of plant.

SEDIMENTATION. Performance of Sedimentation Basins, J. D. Walker. *Am. Water Works Assn.—J.*, vol. 38, no. 9, Sept. 1946, pp. 1078–1082. History of basin design; studies of flow-through settling tanks; discussion of velocity energy, influent and effluent devices, computed displacement velocity, and double-flow tanks.

TREATMENT PLANTS, CLEANING. Dredge Cleans Waterworks Basin Without Interrupting Service. *Eng. News-Rec.*, vol. 137, no. 10, Sept. 5, 1946, pp. 314–315. Half-million-cu yd silt deposit was hydraulically dredged from sedimentation basin of water treatment plant in Philadelphia, Pa., without interrupting service or increasing turbidity.

APPLICATIONS FOR ADMISSION OR TRANSFER

April 1, 1947 — Number 4

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

APPLEGATE, JULIAN EUGENE (Age 49) Staff Officer and Prin. Asst. to Dist. Engr., PRA, Sacramento, Calif.

ARCHER, LAWRENCE JOSEPH (Age 50) Capt., CEC, USNR, Long Beach, Calif.

AULTMAN, WILLIAM WHITESCARVER (Assoc. M.) (Age 41) Water Purification Engr., Metropolitan Water Dist. of Southern California, La Verne, Calif.

BAILEY, ELLSWORTH BARR (Assoc. M.) (Age 47) Staff Engr., The Ralph M. Parsons Co., Washington, D.C.

BELL, WILLIAM HAYES, JR. (Age 45) Architect's Supt., Albert Kahn Associated Architects & Engrs., Inc., St. Louis, Mo.

BLISS, JOHN HARVEY (Assoc. M.) (Age 43), State Engr., Santa Fe, N.Mex.

BOND, WILLIAM JOSEPH (Age 41) With Tennessee Corporation, Oak Ridge, Tenn., as Shift Supervisor.

BOOTH, LOUIS FREDERICK (Age 44) With George A. Fuller Co., New York City.

CEDERGREN, HARRY ROLAND (Assoc. M.) (Age 36) Cons. Engr., O. J. Porter & Co., Sacramento, Calif.

CONNOR, THOMAS ROWLEY (Assoc. M.) (Age 54) Civ. Engr., Div. of Water & Heat, Dept. of Public Utilities, Cleveland, Ohio.

CRITES, EVERETT CLAY (Assoc. M.) (Age 45) Constr. Engr., Chief of Projects Review Div., CAA, Dept. of Commerce, Washington, D.C.

CRITICOS, BASILE JOHN (Age 35) Studying construction methods and equipment in United States, New York City.

DA COSTA, OSCAR MACHADO (Age 52) Chf. Engr. and Gen. Mgr. of his own firm, Rio de Janeiro, Brazil.

DIRLAM, CLYDE NIXON (Assoc. M.) (Age 54) Chf. Bldg. Inspector, Bldg. & Safety Dept., Los Angeles County, Calif.

ERLENKOTTER, ROBERT (Jun.) (Age 34) Col., Corps of Engrs.; Student, Naval War Coll., Newport, R.I.

FRAGIN, ARTHUR HENRY (Age 35) Asst. to Dist. Engr., U.S. Engr. Office, Mobile, Ala.

FENWICK, GEORGE BRADFORD (Age 41) Hydr. Engr., U.S. Waterways Experiment Station, Vicksburg, Miss.

FERRIS, CHARLES BIRDSALL (Assoc. M.) (Age 43) Vice-Pres., Gramatan National Bank, Bronxville, N.Y.

FIELD, STANTON MCNEAL (Age 43) City Engr., Amarillo, Tex.

FIESENHEISER, ELMER I. (Assoc. M.) (Age 40) Associate Prof. of Civ. Eng., Illinois Inst. of Technology, Chicago, Ill.

GIERASCH, AIDEN REDMOND (Assoc. M.) (Age 37) Engr., Jackson & Moreland, Cons. Engrs., Boston, Mass.

GRAHAM, HARRY EDWARD (Assoc.M.) Cons. Structural Engr. (private practice), Corpus Christi, Tex.

HALL, WESLEY MILES (Assoc. M.) (Age 42) Member of firm, Shuford, Yoder & Hall, Gen. Contrs., Westvaco, Tex.

HANNA, WALTER JACOB (Age 62) Private practice; City Engr., Gilroy, Morgan Hill, and San Juan Bautista, Calif.; also County Engr., San Benito County.

HEFELFINGER, CHARLES MOSES (Assoc. M.) (Age 38) Gen. Contr., Charlotte, N.C.

HENDERSON, FRED ROBERT (Age 43) Staff Engr. and Air Installations Officer, Hawaiian Air Material Area, Hickam Field, Hawaii.

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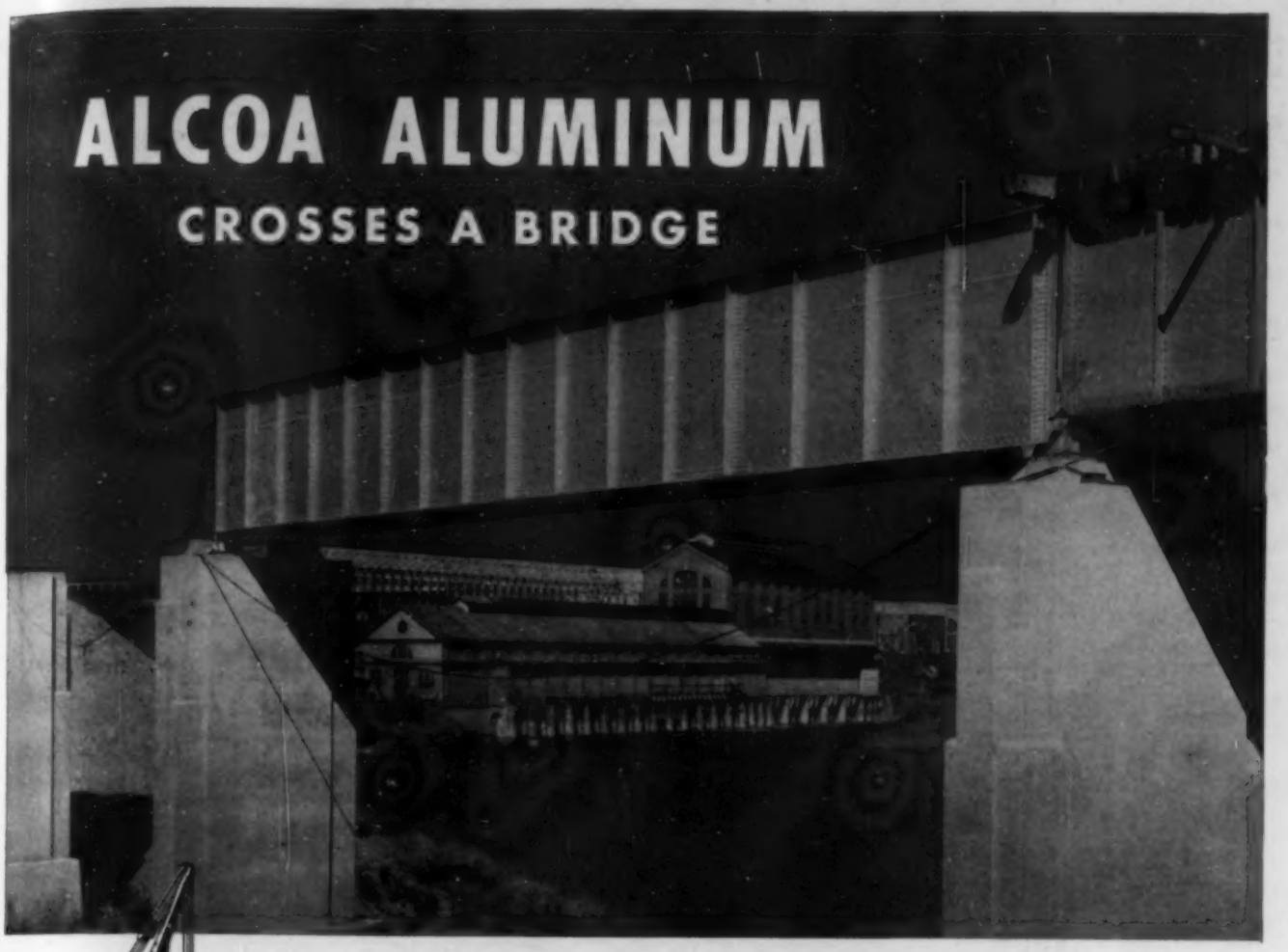

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KUYKENDALL, ROY (Age 43) Constr. Engr., P-4, Bonneville Power Administration, Bellingham, Wash.

LLOYD, G. LLOYD (Age 54) Capt., CEC, USNR, being Officer in Charge of Constr., U.S. Naval Base, Terminal Island, Calif.

MACCLOSKY, CHARLES CONRAD (Assoc. M.) (Age 39) Gen. Mgr., Daley Bros. Corporation, San Francisco, Calif.

MCCLAIN, CHARLES WARNER (Age 57) Engr. of Specification, State Highway Comm. of Indiana, Plainfield, Ind.

MCGRATH, ROBERT LOUIS (Age 45) Senior Engr., U.S. Dept. of Interior, Bureau of Reclamation, Sacramento, Calif.

MARTIN, RANDOLPH LEE ARTHUR (Age 39) Asst. Project Engr., National Tube Co., Lorain, Ohio.

NEBOLSINE, ROSTISLAV (Age 47) Pres., Ranney Water Collector Corporation, New York City.

NELSON, WESLEY ROBERT (Age 49) Regional Director, Region 5, U.S. Bureau of Reclamation, Amarillo, Tex.

PATTEE, KARL MONROE (Age 50) With U.S. Govt., being Executive Officer to Div. Engr., Boston, Mass.

SCHULTZ, WILLARD (Age 40) Engr., Design, Estimate & Specification Branch, U. S. Engr. Office, Buffalo, N.Y.

SEVIAN, VAHÉ JOSEPH (Age 50) Irrigation Engr., Directorate General of Irrigation, Constantinople, Turkey.

SHERMAN, JOHN (Age 51) Estimator-Designer of Structural Steel, Virginia Bridge Co., Roanoke, Va.

SHOREBOTHAM, THOMAS BUNCE (Age 47) San. Engr., Benham Eng. Co., Oklahoma City, Okla.

SMITH, SHERWOOD BADGER (Age 46) Chief, Protective Constr. Branch, Eng. Div., Military Constr., Washington, D.C.

TAYLOR, ASHLEY BRECKINRIDGE (Assoc. M.) (Age 57) Supt. of Constr., Kansas City Power & Light Co., Kansas City, Mo.

TEMPLETON, ALEXANDER SHANNON (Age 43) West Coast Supt., Midland Constrs., Inc., Chicago, Ill., in Los Angeles, Calif.

THOMPSON, ISADORE (Assoc. M.) (Age 36) Cons. Engr. (Private Practice), Redwood City, Calif.

TWING, WAINWRIGHT DARROW (Age 54) Mgr., with J. A. Jones Const. Co., Inc., Houston, Tex.

VAN VRANKEN, HAROLD DOUGLAS (Assoc. M.) (Age 50) Chf. Engr., Jacksonville Terminal Co., Jacksonville, Fla.

YOUNGQUIST, CARL VERNON (Assoc. M.) (Age 43) Chief Engr., Ohio Water Resources Board, Columbus, Ohio.

APPLYING FOR ASSOCIATE MEMBER

BEARD, ABNER HAMILTON, JR. (Jun.) (Age 33) Civ. Engr., Luce & Co., Central Aguirre, Puerto Rico.

BLOTCKY, DONALD EUGENE (Jun.) (Age 28) Office Engr. for T. C. Forrest, Jr., Cons. Engr., Dallas, Tex.

BRANICK, WAYNE D. (Jun.) (Age 34) Civ. Engr. P-3, U.S. Engr. Office, Tulsa, Okla.

CARPENTER, CLYDE CHARLES (Age 28) with California Gen. Petroleum Corp., Los Angeles, Calif.

CHRISTINSON, KENNETH MARIUS (Jun.) (Age 33) Head, Testing Laboratory, U.S. Engr. Dept., Portland, Ore.

CHU, KUANG-HAN (Age 27) Graduate student, Univ. of Ill., Urbana, Ill.

CLOSSON, JOHN EUGENE (Age 32) with Benham Eng. Co., Oklahoma City, Okla.

CORE, EDWIN JOHN (Jun.) (Age 35) Zone Engr., SCS, Portland, Ore.

DARBY, WILTON BROWN (Age 37) Chief Draftsman, Memphis Light, Gas and Water Div., Gas Eng. Dept., Memphis, Tenn.

DAVIS, HUGH JOSEPH (Jun.) (Age 35) I. P. Morris Dept., Baldwin Locomotive Works, Eddystone, Pa.

DOHN, CHARLES WALTER (Jun.) (Age 29) Designer, Howard, Needles, Tammen & Bergendoff, Cons. Engrs., New York City.

DOUMA, JACOB HENDRICK (Jun.) (Age 34) Hydr. Engr. P-5, Office of Chief of Engrs., Washington, D.C.

EL-SAMNY, EL-SAYED AHMED (Age 30) Graduate Student, Univ. of California, Berkeley, Calif.

FEAR, HOLBERT WHITE (Age 56) Hydr. Engr., U.S. Geological Survey, being Administrative Asst. to Dist. Engr., Gloversville, N.Y.

FISHER, WALTER EMIL (Age 33) Field Engr., Stone & Webster Eng. Corporation, Schenectady, N.Y.

FREDIN, JOHN FREDERICK (Age 51) Civ. Engr., City of Duluth, Minn.

GARD, CHARLES METHENY (Jun.) (Age 35) Chief, San. Sc., Office of First Army Engr., Governors Island, N.Y.

GILBERT, JAMES KAILER (Age 39) Jun. Asst. Bridge Engr., Maryland Roads Comm., Baltimore, Md.

GUILLARD, EUGENE (Jun.) (Age 35) Design Engr., Howard, Needles, Tammen & Bergendoff, Cons. Engrs., New York City, address St. Elmo, Ill.

HARRISON, JOHN BARRETT (Age 40) Design Engr., Office of Clyde C. Kennedy, San Francisco, Calif.

HAVENS, BERNARD WILSON (Age 28) Squad Leader and Designer, Knappen Eng. Co., New York City.

HELGERSON, HOWARD CARLTON (Age 33) Vice-Pres., Secy. & Gen. Mgr., McKoy-Helgerson Co., Inc., Greensville, S.C.

HITCHCOCK, JOHN (Age 42) Designing Engr., Johannessen & Girand, Engrs., Phoenix, Ariz.

HUBBARD, WARREN MELVILLE (Age 35) Development Engr., Kaiser Co., Inc., Redlands, Calif.

HYDEN, BAILEY SYLVANIUS (Jun.) (Age 36) Supervy. Engr., Koch & Fowler, Cons. Engrs., Dallas, Tex.

JONES, MALCOLM HALLEY (Jun.) (Age 34) Chief, Coordination of Plans Sec., Branch of Project Planning, U.S. Bureau of Reclamation, Washington, D.C.

JONES, SAMUEL LEARY (Jun.) (Age 33) Prin. San. Engr., Stream Pollution Control, Tennessee Dept. of Public Health, Nashville, Tenn.

LAIRD, KNIGHT (Jun.) (Age 34) Project Engr., Pioneer Contr. Co., Memphis, Tenn.

LOUIS, LEO, JR. (Age 31) Chief, Div. of Water Supplies, Bureau of San. Eng., Indiana Board of Health, Indianapolis, Ind.

LOWE, JOHN, III (Jun.) (Age 31) Soils and Foundations Engr., Knappen Eng. Co., New York City.

LUNDHEIM, ERLING JACOB (Jun.) (Age 34) State Highway Dept., Minneapolis, Minn.

MCREYNOLDS, JOHN WORTH (Jun.) (Age 34) Asst. Div. Engr., Chicago, Milwaukee & St. Paul R.R., La Crosse, Wis.

MASON, ROBERT KENDALL (Age 36) Field Project Mgr., Dupont Co., Clinton, Iowa.

MAUTZ, FERDINAND FRANCIS (Jun.) (Age 32) Pacific Gas & Elec. Co., Richmond, Calif.

MAYFIELD, GEORGE MALCOLM (Jun.) (Age 24) Asst. Res. Engr., U.S. Engr. Dept., Galveston, Tex.

MONSON, LYLE EDWARD (Jun.) (Age 34) Structural Designer and Detailer, Cowles & Co., Engrs., Chicago, Ill.

NIELSEN, JENS PETER (Jun.) (Age 35) Asst. Engr., U.S. Engr., U.S. Geological Survey, Rolla, Mo.

ORLAND, HERBERT PAUL (Jun.) (Age 33) Asst. Editor, Technical Publications, ASCE, New York City.

PARAUD, RAUL (Age 35) Chief, Maintenance Dept. of Apurimac, Lima, Peru.

PAULHUS, JOSEPH LOUIS HONORE (Age 37) Meteorologist, U.S., Weather Bureau, Washington, D.C.

PINKERTON, RICHARD DAVID (Jun.) (Age 32) Lt. Cmdr., CEC, U.S. Navy, Brooklyn, N.Y.

ROBERTS, ERB CLARK (Age 35) Engineer-Clerk of Works, Vanderbilt Univ., Nashville, Tenn.

SHEPARD, ROBERT EASTON (Jun.) (Age 35) Asst. Engr., Office of Post Engr., Fort Lawton, Wash.

SINGELL, THOMAS WILLIAM (Age 32) Design Engr., International Derrick & Equipment Co., Columbus, Ohio.

SLATER, WILLARD RUSSEL (Age 31) Head, Flood Design Sec., Engr. (P-4) Hydr., Bureau of Reclamation, Dept. of Interior, Boulder City, Nev.

SLAYBAUGH, ANDREW JAMES (Age 37) Design Engr., Havens & Emmerson, East Cleveland, Ohio.

SULLIVAN, ARTHUR BUSHNELL (Jun.) (Age 34) City Mgr. and City Engr., San Mateo, Calif.

THOMAS, LEWIS COLTON JOHN (Age 30) Engr., Public Works Dept., Trinidad, B.W.I.

TONETTI, FREDERICK CHARLES (Jun.) (Age 34) Hydr. Eng., Ebasco Services, Inc., New York City.

VOLZ, LAWRENCE HENRY (Jun.) (Age 34) Structural Designer and Detailer, Chicago, Milwaukee, St. Paul & Pacific R.R., Grayslake, Ill.

WALKER, WILLIAM TRAVIS (Age 36) Civ. Engr., Aluminum Co. of America, Power Div., Alcoa, Tenn.

WARREN, MOULTRIE ALFRED (Jun.) (Age 34) Associate Hydr. Engr., U.S. Geological Survey, Water Resources Branch, Div. of Ground Water, Washington, D.C.

WILDE, HAROLD ARTHUR (Jun.) (Age 35) Asst. Dist. Airport Engr. P-5, with CAA, College Park, Ga.

WILLIAMS, HOWARD MARSHALL (Age 35) Engr., U.S. Engr. Dept., Washington, D.C.

WILSON, JACK HOWARD (Age 28) Engr., Little Rock Municipal Water-Works, Little Rock, Ark.

WINTERS, ALFRED CALVIN (Jun.) (Age 34) Engr. (Hydr.) (P-2), U.S. Engr. Office, Hydrology-Reservoir Operations Sec., Reservoir Operations Sub-section, Tulsa, Okla.

APPLYING FOR JUNIOR

BURROUGHS, ISAAC LUMPKIN (Age 27) Civ. Engr. TVA, Knoxville, Tenn.

D'AMELIO, JOSEPH HORACE, JR. (Age 27) Senior Detailer, Link-Belt Co., Philadelphia, Pa.

DAWLEY, FREDERICK MARTIN (Age 26) Soils Testing Engr., State Highway Dept., Detroit, Mich.

DE LA SAYETTE, EMMANUEL RENÉ (Age 24) Trainee (Mission French Govt.), Bureau of Reclamation, Denver, Colo.

DOBERNE, MORRIS (Age 27) Structural Engr., Robinson & Steinman, New York City.

GENTILE, JERRY JOSEPH (Age 31) Instructor, Civ. Eng., Rhode Island State Coll., Kingston, R.I.

GOETZMAN, ROBERT RENN (Age 29) Engr., Louisville Bldrs. Supply Co., Louisville, Ky.

LAUGHTER, CLYDE NEELY (Age 33) with FRA, Florence, Ala.

LYON, OSCAR T., JR. (Age 28) Transitman, Arizona Highway Dept., Florence, Ariz.

MEERS, CHARLES HERBERT (Age 21) Supt., R. P. Farnsworth & Co., Inc., Houston, Tex.

MOORE, DAVID (Age 25) Graduate student, Univ. of Utah, Salt Lake City, Utah.

NAESER, CHARLES JOSEPH (Age 25) Inspector, Consoer, Townsend & Associates, Milwaukee, Wis.

PAINTER, WILLIAM DONALD (Age 27) Tolona, Ill.

ROW, K. R. NARAYANA (Age 25) Carnegie Inst. of Technology, Pittsburgh, Pa.

SALBAING, JACQUES LOUIS (Age 26) Trainee (Mission French Govt.), Bureau of Reclamation, Denver, Colo.

SCOULAR, PETER GRAY (Age 23) Asst. Structural Engr. with A. H. Manson, Registered Archt., Christchurch, N.Z.

SELLECK, HERBERT HARRY, JR. (Age 29), Ames, Iowa.

SPEARS, RALPH EDWARD (Age 29) Structural and Architectural Designer, Archer, Cooper & Robison, Archts. & Engrs., Kansas City, Mo.

STASEK, JACOB ANTHONY (Age 31) Civ. Engr., SCS, U.S. Dept. of Agriculture, Milwaukee, Wis.

STEYN, ABRAHAM PIETER KEEVE (Age 24) Student, Graduate School of Eng., Harvard Univ., Cambridge, Mass.

TORRES, ANTONIO RAPHAEL (Age 24) Designer, U.S.E.D., San Juan, Puerto Rico.

WISS, JOHN FRANK (Age 27) Graduate Student, Northwestern Univ., Evanston, Ill.

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UNIV. OF ILL.

BOGGIS, LEO VICTOR, 1947	(29)
BREININ, LAWRENCE JOSHUA, 1947	(21)
BRISCOE, JOHN WILLIAM, 1940 and 1947	(30)
COOKE, WILLIAM ROBERT, 1947	(21)
DANNER, CHARLES STEELMAN, 1947	(28)
FUCHS, PAUL, 1947	(21)
GULLETTE, CAMERON CHARLES, JR., 1947	(34)
IRELAND, HERBERT ORIN, 1940 and 1947	(37)
KHACHATURIAN, NARBEY, 1947	(33)
LEVITT, ALBERT, 1947	(23)
MAHAN, ROBERT DALE, 1947	(34)
NICEWANDER, MERLE WELDON, 1947	(24)
OBERFRANC, JOSEPH, 1947	(33)

IOWA STATE COLL.

BRADSHAW, ODELL BORGSTROM, 1946	(24)
JORDAN, ROBERT WILLIAM, 1946	(22)
KJOSNESS, ROBERT WENSEL, 1946	(24)
LATENSER, FRANK NESTOR, 1946	(21)
RICHTER, HOWARD JAY, 1946	(23)

STATE UNIV. OF IOWA

MILLER, IRENE ELIZABETH, 1947	(30)
PETERSON, MARGARET SARA, 1947	(26)

KANS. STATE COLL.

BANDY, ALVA HARLAN, 1947	(24)
BUDD, WILLIAM EDWARD, 1947	(23)
HERSHEY, HARRY JUNIOR, 1947	(26)
VON UNWERTH, HANS, 1947	(26)

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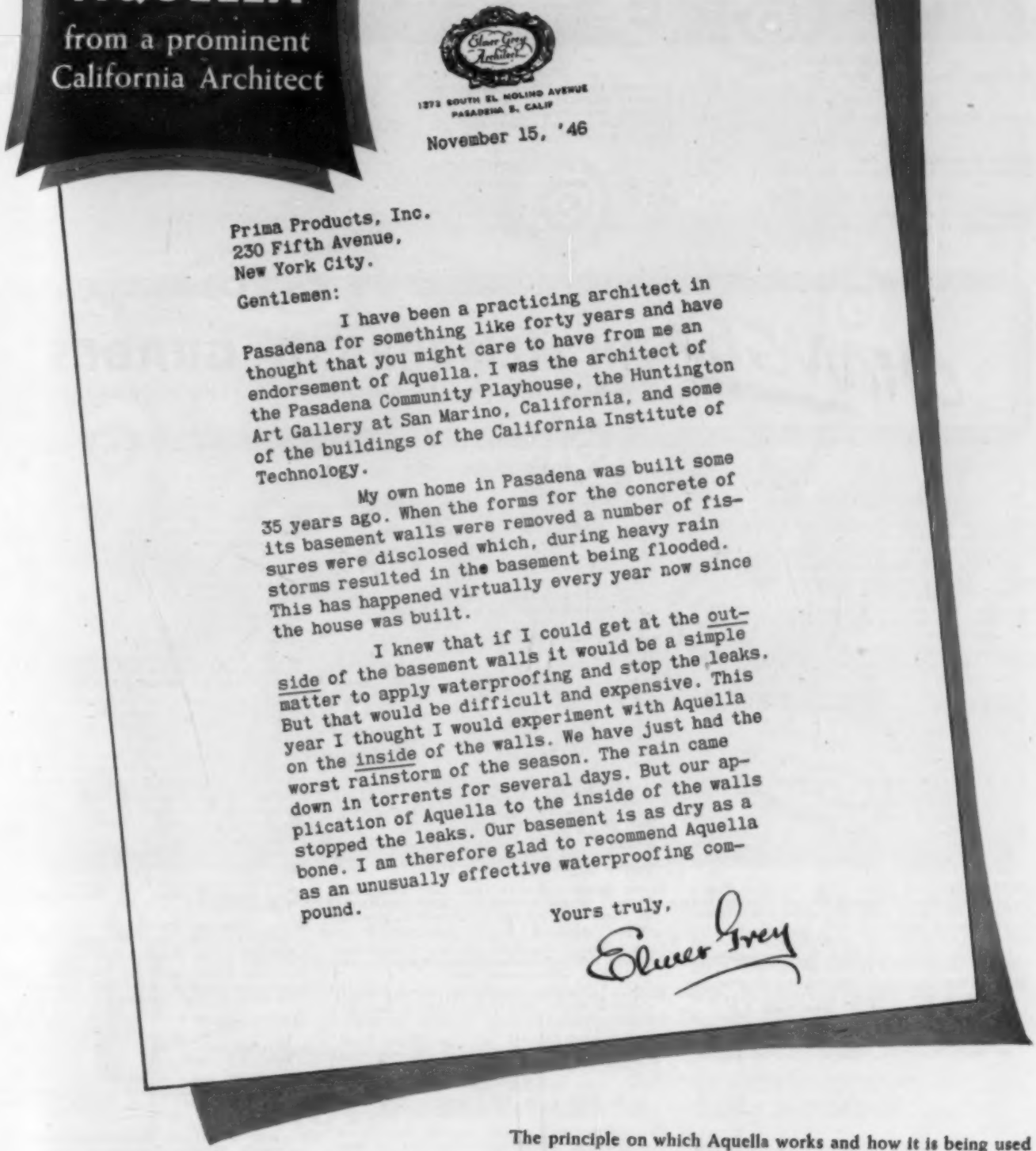

Elmer Grey Architect
1372 SOUTH EL MOLINO AVENUE
PASADENA 5, CALIF

November 15, '46

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ASTURIAS, MIGUEL ANTONIO, 1947 (20)
BECKER, ALAN ARTHUR, 1947 (21)
BIRNBAUM, HAROLD, 1947 (22)
BUFORD, ROBERT STROTHER, 1947 (23)
FONG, ISIDRO, 1947 (25)
MACRAE, BRUCE ROBERT, 1947 (24)
MARKS, ROBERT HUTCHINSON, 1947 (20)
PALETZ, HARRY JULIUS, JR., 1947 (26)
PICARDI, EGIDIO ALFRED, 1947 (25)

MICH. STATE COLL.

ELLISON, HAROLD RAYMOND, 1946 (25)

UNIV. OF MICH.

HAUSMAN, LAWRENCE ALBERT, 1947 (23)

UNIV. OF MINN.

CONVERSE, DEAN JOHN, 1947 (25)

MISS. STATE COLL.

JONES, WHITNEY BUFORD, 1947 (23)

UNIV. OF MO.

BILBY, JOHN EDMUND, 1947 (31)
CLEAVELAND, ALTON BRUCE, JR., 1947 (28)

COLL. OF CITY OF N.Y.

BARLIN, MURIEL ESTELLE, 1947 (21)
CRITCHLOW, WINSTON HENRY, 1947 (28)

COLUB, EZRA, 1947 (22)
KOURELAKOS, LOUIS, 1947 (22)
LA VALLA, DOMINIC CHARLES, 1947 (24)
MAGER, STANLEY, 1947 (22)

UNIV. OF N. DAK.

SALTMAN, BRUCE, 1947 (24)

NORTHEASTERN UNIV.

PACELLI, ALFRED JOHN, 1947 (21)

UNIV. OF NOTRE DAME

BARTLETT, WILLIAM REEVES, 1947 (22)
COYLE, ROBERT WILLIAM, 1947 (22)
McCARTHY, FRANCIS FINNEY, 1947 (23)
SCHOEN, JAMES MILO, 1947 (22)

PURDUE UNIV.

ASCHNER, ULRICH FELIX, 1947 (22)
CORMAN, STANLEY IRA, 1947 (23)
DUNBER, JOHN FRANK, JR., 1947 (21)
HOPE, DONALD BEAUMONT, 1947 (26)
KELLY, RALPH GORDON, 1947 (27)

R.I. STATE COLL.

ROCKWELL, WALTER GORMAN, 1947 (29)

RUTGERS UNIV.

MARLOWE, EUGENE W., 1947 (25)

UNIV. OF SO. CALIF.

BARRETT, WALTER RALPH, 1947 (2)
BELL, JAMES G, 1947 (2)
ISAACS, ALVIN SIMON, 1947 (2)

TEX. A&M COLL.

FALLWELL, FRANCIS XAVIER, 1947 (2)
HAMERSLY, JAMES WILLIAM, 1947 (2)
MUIR, CLIFFORD DONALD, 1947 (3)
REAGAN, CHARLES WILLIAM, 1947 (3)

VA. POL. INST.

ROBERTSON, DAVID ADOLPHUS, JR., 1946 (3)

WASH. STATE COLL.

SCALZO, ROBERT JOSEPH, 1947 (3)

UNIV. OF WASH.

HERVIN, ALBERT WILLIAM, JR., 1946 (3)

UNIV. OF WIS.

BARNES, GLEN EDWARD, 1947 (3)
BIRKETT, RICHARD BEAUMONT, 1947 (3)
FRAZIER, DONALD FINLEY, 1947 (3)
KNOERR, DAVID CHARLES, 1947 (2)

WORCESTER POL. INST.

WRIGHT, DAVID JOY, 1946 (3)

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

CHANGES IN MEMBERSHIP GRADES

ADDITIONS, TRANSFERS, REINSTATEMENTS, AND RESIGNATIONS

From February 10 to March 10, 1947, Inclusive

Additions in Membership

ALFORD, JOHN ATEN (Jun. '47) 4921 La Roda Ave., Los Angeles, Calif.

ALIANAK-CARMONA, HENRY MARK (Jun. '47), Pelegrine 1620, Rosario De Santa Fe, Argentina.

ALVY, DANIEL THEODORE (Jun. '47), 5600 Lexington Ave., Hollywood 38, Calif.

AMBLER, EDWARD CARY, JR. (Assoc. M. '47), Public Utilities Engr., State Corp. Comm., Richmond 19, Va.

AMY, LYDON EIDLITZ (Jun. '47), Senior Draftsman, Stone & Webster Eng. Corp., 49 Federal St. (Res., 2 Otis Place), Boston, Mass.

ANDRUS, LEONARD ALEXANDER (M. '47), Asst. Engr. Comm. of Public Docks, 1884 North West Front Ave. (Res., 2488 South West Sherwood Dr.), Portland 1, Ore.

ASPLUND, SVEN OLOF (M. '47), Drottninggatan 63, Orebo, Sweden.

BAKER, CLAUDE VARNEY (Jun. '46), Reinforcing Steel Detailer, Bethlehem Pacific Coast Steel Corp., 3147 Terminal Station (Res., 12860 Twenty-fourth South), Seattle 88, Wash.

BALDWIN, FRANCIS COUPER (Jun. '47), Asst. Engr., Gen. Engr. Dept., The C. & P. Telephone Co. of Va., 701 East Grace St. (Res., 3323 West Franklin St.), Richmond, Va.

BARNES, BERNARD ADAIR (Jun. '46), Civ. Engr., Western Union Telegraph Co., 60 Hudson St., New York (Res., 4293 Richmond Ave., Eltingville, Staten Island 12), N.Y.

BASTESEN, OLAF (M. '47), Asst. Subway Structural Designer, Dept. Subways & Superhighways, Rm. 1940, 20 North Wacker Dr., Chicago 6, Ill.

BEATON, DANIEL (Jun. '46), Senior Draftsman, Ebasco Services, 2 Rector St. (Res., 1745 Eastburn Ave., New York 57), New York, N.Y.

BEHREND, CARL LOUIS (Assoc. M. '47), Asst. Civ. Engr., City of Los Angeles, City Hall. (Res., 428 North Hart Ave., Temple City), Los Angeles, Calif.

BEHREND, ROBERT LYNN (Jun. '47), Engr., Special Eng. Div., Soils & Foundations. (Res., Box 338, Diablo Heights), Diablo Heights, Panama Canal Zone.

BELLINGER, HARRY O'BANNON (M. '47), City Engr.'s Office, Columbia, S.C.

BENKE, SYLVESTER HERMAN (Assoc. M. '47), Estimating Engr., Cleveland Electric Illuminating Co., 75 Public Square. (Res., 15305 Huntmere Ave.), Cleveland 10, Ohio.

BOEHMIG, ROBERT LAIRD (Jun. '47), Student, Georgia Tech., Atlanta, Ga. (Res., 3728 Wapello St., Pittsburgh 12, Pa.).

BOUQUARD, JOSEPH PETER (Assoc. M. '47), Structural Engr., L. A. Schmidt, Jr., Engr., 214 Chattanooga Bank Bldg. (Res., 905 Tremont St.), Chattanooga, Tenn.

BREITLING, THOMAS OTTO (Jun. '47), Architectural Engr., War Dept., Army Air Force, Air Installations, Brookley Field. (Res., 1357 Springhill Ave.), Mobile 17, Ala.

BUTLER, ALLEN GEORGE (Jun. '46), Stress Engr., Piper Aircraft Corp., Lock Haven. (Res., Winburne), Pa.

BUTLER, ALLEN GEORGE (Jun. '46), Stress Engr., Piper Aircraft Corp., Lock Haven (Res., Winburne), Pa.

CARLSON, ELMER HUGO (M. '47), Structural Engr., Jackson & Moreland, 31 St. James Ave., Boston (Res., 2 Endicott Ave., Marblehead), Mass.

CHAMBERLIN, FREDERICK BRYAN (M. '47), Town Engr., Town of West Hartford, Town Hall, West Hartford, Conn.

CHENOWETH, THOMAS EDWIN (Assoc. M. '47), Utilities Engr., Dept. of Public Works, City of Kansas City (Res., 411 East 12th St.), Kansas City, Mo.

CHESNEY, WILLIAM ANTHONY (Jun. '47), Draftsman, Jackson & Moreland Engrs., 31 St. James Ave., Boston 16, Mass. (Res., 319 Freeport St., New Kensington, Pa.)

CIFFRIN, ASSAF (M. '47), Senior Research Engr., Aero. Dept., New York Univ. (Res., 325 Central Park West), New York 25, N.Y.

CLAPP, MERWIN BAILEY (Jun. '47), Draftsman, Chicago Bridge & Iron Co., 1500 North 50th St. (Res., 5342 Seventh Court South), Birmingham, Ala.

CLARK, ROBERT NEWTON (M. '46), Chf., Public Health Engr., Tennessee Valley Authority, Old Post Office, Chattanooga, Tenn.

COLLIER, ALTON RAY (Assoc. M. '47), Civ. Engr., Corps of Engrs., War Dept., 1709 Jackson St., Omaha, Nebr.

COOK, ROBERT LEE (M. '47), Asst. Const. Engr., Missouri Pacific Lines, 204 Union Station (Res., 2336 Wroxton Road), Houston, Tex.

COYNE, JOHN WILLIAM (Jun. '47), Asst. Engr., M. W. Kellogg Co., 225 Broadway, New York, N.Y. (Res., P. O. Box 1546, Casper, Wyo.)

CRISPEN, ROBERT ELWOOD (Jun. '46), Instr., Dept. of Civ. Eng., Lehigh University (Res., 15 West Garrison St.), Bethlehem, Pa.

DAVY, WALTER EDWIN (Assoc. M. '47), Chf., Constr. Section, A.A.F., Headquarters, Air Material Commando, Wright Field, Dayton (Res., 619 Lucas Dr., Xenia), Ohio.

DELL'ABATE, RALPH (Jun. '46), Stress Analyst, George P. Wagner Associates, 61 Broadway, New York (Res., 18 Bay Seventh St., Brooklyn 28), N.Y.

DICKINSON, WILLIAM DEWOODY, JR. (Assoc. M. '47), (Dickinson & White, Inc.), 115 North Spring (Res., 479 Ridgeway), Little Rock, Ark.

DISCHINGER, JAMES BENDER (Jun. '47), Capt., U.S. Army, Gloucester, Va.

DOWNS, HUGH GIFFORD (Jun. '47), Senior Bridge Draftsman, Bridge Dept., State Road Comm., 108 East Lexington St. (Res., 608 Linnard St.), Baltimore 29, Md.

DRYDEN, CHARLES WATSON (Assoc. M. '47), Civ. Engr., P. O. Box 152, Flagstaff, Ariz.

EBERHARDT, FRANK CHRISTOPHER (Jun. '47), Asst. Engr., Morrison-Knudsen Co., Inc., Kortes Dam, Box 440, Casper, Wyo.

EKIZIAN, HARRY, JR. (Jun. '46), Designer, Knappen Eng. Co., 280 Madison Ave., New York 18 (Res., 188 Clayton Rd., Scarsdale), N.Y.

ERSKINE, BAYARD CASS (Assoc. M. '47), Office Engr., Design Dept., Tennessee Valley Authority, 302 Union Bldg. (Res., 9 Century Court), Knoxville 16, Tenn.

FERGUSON, ORAN EUGENE (Jun. '47), Topographic Engr., U.S. Geological Survey, Box 133, Rolla, Mo. (Res., Kincaid, Kans.)

FIDELMAN, SAUL (Jun. '47), Hydr. Engr., Hydr. Laboratory, U.S. Engrs., Iowa City, Iowa.

FISKE, GORDON LYMAN (Jun. '47), Asst. in Civ. Eng., Pennsylvania State College (Res., 310 South Allen St.), State College, Pa.

FRANK, ABBOTT (Jun. '47), Postgraduate Student, Polytechnic Institute of Brooklyn, 99 Livingston St., Brooklyn (Res., 117 Wallace Ave., Mt. Vernon), N.Y.

FRANK, HOWARD GREENLEAF (Assoc. M. '47), Bridge Designer, State Highway Dept. (Res., 878 South State St.), Dover, Del.

FREEMAN, ALVIN ZELL (Jun. '46), Engr., Freeman Industrial Service, 450 North Main St. (Res. 18 Bellevue Ave.), Providence 7, R.I.

FRINCKE, HAROLD CARL (Assoc. M. '46), Landscape Archt., Tennessee Valley Authority, 537 New Sprankle Bldg. (Res., 2211 West Clinch Ave.), Knoxville, Tenn.

FROEMMING, GALE ARTHUR (Jun. '47), (W. A. Froemming & Sons), 4380 North Green Bay Ave. (Res., 3144 North Humboldt Ave.), Milwaukee, Wis.

FURMAN, HAL MYRON (Jun. '46), Graduate Engr., Howard, Needles, Tammen & Bergendoff, 55 Liberty St., New York, 5, N.Y.

GANONG, CARL FIELD (M. '47), Chf., Civ. Engr. Section, 13th C. G. Dist., U.S. Coast Guard 1016 New World Life Bldg., Seattle, Wash.

GARDNER, WILLIAM HENRY, JR. (Jun. '47), Instr., Civ. Eng. Dept., Duke Univ. (Res., Box 338, College Station), Durham, N. C.

GLASSMAN, DAVID (Jun. '46), 1320 Fifty-First St., Brooklyn, N.Y.

(Continued on page 88)

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Engineer; Jun. ASCE; 26; single; B.C.E.; former construction superintendent of $50,000 residence. Experienced in estimating quantities, layout, coordinating subcontractors, etc., for residential and small industrial buildings. Recently chief engineer of 10,000-ton USN ship. Desire responsible construction position in New York area, preferably with residential builder. C-357.

Estimator; Assoc. M. ASCE; licensed P.E.; graduate C.E.; cost analysis, design, office and field engineer, safety, bid preparation; 15 years on foundation, building, tunnel, dam, shaft, and airfield construction. Veteran Seabee officer. Desire permanent association with contractors in New York area. Available April 1. C-358.

Structural Engineer; Assoc. M. ASCE; age 41; 20 years' experience, subdivided roughly: 1 year teaching, 4 years structural drafting and design, 4 years surveying, 3 years construction supervision, 4 years valuation and cost analysis, and 4 years' production work in war plants and elsewhere. Recently back on construction management. Would consider foreign assignments. C-359.

Executive Engineer; M. ASCE; 37; registered professional engineer; Commander, CEC, USNR; Commanding Officer, Seabee Battalions, Atlantic-Pacific areas; design manager, $60,000,000 work; resident engineer; wide experience on design, maintenance, and construction of large projects, with consultants, contractors (bridges, airports, hospitals, industrial, public works). Excellent references. C-360.

Positions Available

Civil Engineers, preferably single, with knowledge of Spanish, but married men with experience will be considered for surveying of field engineering work; some experience necessary; 3-year contract. Salary, $4,200–$4,800 a year. Location, South America. W-8602(*a*).

Civil Engineer, single, 30–35, with mill and plant construction experience, to act as assistant to job engineer on chemical project. Knowledge of Spanish desirable. Salary, $5,000 a year. Location, Mexico. W-8608.

Civil Engineer, with underpinning experience, to design and lay out concrete supports, estimate quantities, and probably do some field engineering. Salary, $4,160 a year. Location, New York, N.Y. W-8630.

Research Engineers, Civil Graduates: (*a*) Engineer with 10 years' general engineering experience, principally in water supply and sanitary engineering, and ability to analyze field data and prepare reports. (*b*) Engineer with 10 years' experience, principally in cost estimating, having knowledge of construction material, shipping methods, and handling cost. Must prepare statistics and reports. (*c*) Engineer capable of assembling data from libraries, government agencies, and other sources of physiography and engineering economics. (*d*) Engineer, experienced principally in testing of construction materials, analysis of boring and construction methods, with ability to schedule work and prepare reports. (*e*) Senior Engineer, graduate, with 20 years' experience in civil, mechanical, and sanitary engineering, to organize and direct the preparation of reports on basic water-supply requirements, sanitary sewage and storm water disposal, power requirements and distribution systems. Salaries: *a*, *b*, *c*, $5,100; *e*, $8,100 a year. Locations: *a*, *b*, California; *c*, New York, N.Y.; *d*, *e*, Guam. W-8639.

Civil Engineer, with at least 5 years' plant engineering experience, to make surveys, design, and lay out industrial building additions, conveyors, equipment foundations, etc., for machinery manufacturer. Salary, $4,000 a year. Location, New York metropolitan area. W-8642.

Civil Engineer, 25–30, with structural-steel and plate-fabrication experience, to handle inquiries, estimates, specifications, and quotations in export sales field. Salary, $2,400–$3,600 a year. Location, New York, N.Y. W-8658.

Plant Engineer, Civil, 35–45, with experience in construction and general plant engineering, for process plant in food industry. Salary, about $5,000 a year. Location, New York metropolitan area or Pennsylvania. W-8668.

Designer-Draftsman, structural engineer, with 7 or 8 years' experience in design of industrial and commercial buildings in steel and reinforced concrete. Location, New York, N.Y. W-8671 (*a*).

Design Engineer, graduate, well experienced in structural steel and reinforced concrete foundations. Minimum of 5 years' actual design experience required. Will have responsible charge of structural steel design and foundations necessary for equipment and buildings of chemical plants, gas plants, etc. Some traveling. Salary, $4,800–$6,000 a year. Location, Ohio. W-8673 (*a*).

Superintendent of Construction or Project Engineer to take charge of construction of large industrial gas, oil, or chemical plants. Salary, $7,500–$10,000 a year. Headquarters, Ohio. W-8674 (*a*).

Structural Engineer, young, with some experience in truss fabrication as well as building construction. Should be able to do detail drafting, take-off, and estimating work from plans, for steel plant. Location, Tennessee. W-8690.

Estimator, experienced. Must be capable of making complete quantity surveys and be familiar with costs on industrial and commercial buildings, to supervise estimating department. Excellent opportunity with well established building contractor. Write stating training, experience, and salary expected. Location, Pennsylvania. W-8703.

Inspector and Expediter, with 5 to 10 years' experience on the construction and testing of Diesel engines. Will represent company at plant of subcontractor. Salary, $3,200 a year plus living expenses. Location, Pennsylvania. W-8725.

Architectural or Civil Engineer, with several years' experience with general contractor on industrial and commercial buildings. Duties largely field supervision, but should be capable of some design and drafting, for architectural engineering firm. Write full particulars. Salary open. Location, Ohio. D-3354.

Instructors and Assistant or Associate Professor for Civil Engineering Department. Instructors to handle surveying courses. Professor will gradually take over in field of hydraulics, hydrology, and related subjects. Positions start September 1947. Salaries: Instructors, $2,400 up; Assistant Professor, to $3,200; Associate Professor, $3,600–$4,000 for nine months. Location, Nebraska. R-4083C.

Instructor to teach subjects mainly in the structural engineering field. Should be able to handle laboratory work in materials testing and probably teach strength of materials. Position starts September, 1947. Salary, $2,000–$2,700. Location, Pennsylvania. R-4088C.

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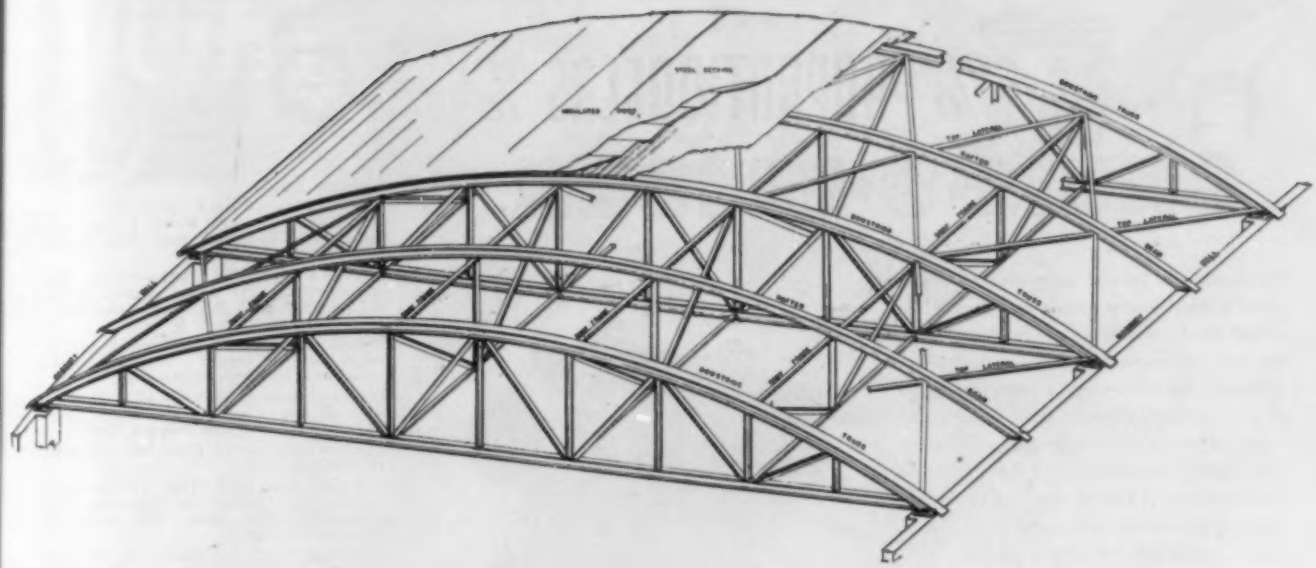

THE arc welded bow string roof truss shown above is intended for a 72-foot clear span roof supported on masonry walls, used in combination with an insulated steel deck. This type roof is ideal for large store buildings, hangars, garages, small factories, display rooms, etc.

The bow string truss is economical—uses only 4.4 lbs. of steel per square foot of area for the truss shown—and provides wide entrance-exit openings at ends of the building.

The truss consists of curved 6″-wide flanged top chord sections, 6″ light beam section bottom chords and 3″ x 4″ T section web members joined by electric arc welding. Trusses are spaced at 18′-0″ centers and span 72′-0″. Curvature radius of the top chord is 72′, same as span length. Trusses are 9′-7¾″ deep, center to center of chords, at the middle.

MINIMIZES STRESSES

Truss weight is estimated at 3200 lbs. per truss or 45 lbs. per foot of one truss. The dead load from roofing materials is slightly less than 12 lbs. per square foot. An analysis of the dead load web stresses reveals that they are very small. In fact, the truss is designed so that, under the dead load or a uniform snow load covering the whole span, there is no beam action of the top chord, the stress in every diagonal is zero and the stress is constant throughout the bottom chord. Under half live load conditions, the stresses in the web members alternate between tension and compression going from one member to the next along the truss. Both the chord and web stresses are reversible under varying wind conditions—the same member acting either in tension or compression depending on which way the wind is blowing.

RAFTERS AUGMENT TRUSSES

In addition to the bow string trusses, the roof decking gets support from light intermediate-curved 6″ joist section rafter beams. These make the truss spacing independent of the purlin span. In longer spans, 2, 3 or more of these intermediate rafters should be used between trusses for economy.

Rafters are 5-span continuous beams supported at intervals of 14′-4¾″ by the longitudinal sway frame trusses, and supported transversely by the top lateral bracing. In turn, the rafters cut down the unsupported length of the laterals.

REQUIRES LITTLE FIELD WELDING

Both the 72-foot trusses and the sway frames are designed to be completely fabricated in the shop. Field erection welding is confined to joining the sway frames, rafter beams, top laterals and roof decking.

A detailed study of this roof and the bow string type truss is made in a new series of Plates of "Studies in Structural Arc Welding," published by Lincoln Electric. To be placed on the mailing list for these and future Studies, write The Lincoln Electric Company, Dept. 272, Cleveland 1, Ohio.

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(*Continued from page 84*)

GLIDDEN, HORACE KNIGHT (M. '47), Dist. Airport Engr., U.S. Civ. Aeronautics Administration, P. O. Box 2618 (Res., 121 Main St.), Boise, Idaho.

GUREWITZ, MILTON ALLEN (Jun. '47), Structural Engr., National Housing Agency, 4th & Adams Dr. S.W. (Res., 7019 Georgia Ave. N.W.), Washington 12, D.C.

GWATHMEY, CABELL (M. '47), Chf., Eng. Dist., San Francisco Dist., Corps of Engrs., War Dept., 74 New Montgomery St., San Francisco 19, Calif.

HALL, JOHN HENRY (Assoc. M. '47), Constr. Supt., Industrial Eng. Co., 38 North Ferry St., Albany (Res., 21 Circuit Rd., New Rochelle), N.Y.

HALL, RAYMOND EDWARD (Assoc. M. '47), Engr. & Chf. Deputy, Lucas County Eng. Dept., Court House (Res., 1911 Freeman St.), Toledo 6, Ohio.

HARPER, HAROLD FRANCIS (Assoc. M. '47), City Engr., City of Salina, City Hall, Salina, Kans.

HARRIS, LUCIAN JEFFERSON, JR. (Assoc. M. '47), Chf. Draftsman, Chicago Bridge & Iron Co., Box 277, Birmingham, Ala.

HARTMAN, HARRY ROBERT (M. '47), Chf. Engr., Witco Chemical Co., 6200 West 51st St., Chicago 38, Ill.

HASTAIN, JAMES EDWIN (M. '47), Cons. Engr., 1114 North 7th St., Phoenix, Ariz.

HENDRIKSEN, OSCAR HAGBARTH (Assoc. M. '47), Civ. Engr., The Texas Co., 927 South Broadway, Los Angeles 15 (Res., 10460 Kinnard Ave., West Los Angeles 24), Calif.

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HILL, WILLIAM BYRON (Jun. '47), Asst. Office Engr., Ditmars Dickmann Constr. Co., 804 Barnes Bldg. (Res., 2301 Oklahoma), Muskogee, Okla.

HOAGLAND, WILBUR WRIGHT, JR. (Jun. '46) (Hoagland-Findlay Engr. Co.), 3254 Cherry Ave., Long Beach, Calif.

HOOK, WALTER ALLAN (Jun. '47), Civ. Engr., Aberthaw Co., 80 Federal St., Boston (Res., 38 Greenleaf St., Quincy), Mass.

IRWIN, HARRY FUNSTON (Assoc. M. '47), Technical Consultant, Warner Co., Schaff Bldg., 1505 Race St., Philadelphia 2, Pa.

JENNINGS, WILFRED ROBERT (Assoc. M. '47), Acting City Engr., Planning Engr., City of Santa Cruz, Room 10, City Hall (Res., 41 Younglove Ave.), Santa Cruz, Calif.

JOB, RICHARD DALE (Jun. '46), Design Engr., International Eng. Co., Inc., 427 Chamber of Commerce Bldg., Denver 6, Colo.

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KANTEY, BASIL AVRON (Assoc. M. '47), Box 3132, Cape Town, South Africa.

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KELLY, EUGENE THOMAS (Jun. '47), With City Eng. Dept., Nashville, Tenn.

KNUDSON, THEODORE ELMER (Jun. '46), Junior Engr., M. O. Syllianasen, Cons. Engr., 986 Dexter Horton Bldg. (Res., 12860 Twenty-fourth South), Seattle, Wash.

KUKRAL, ALLAN CHARLES (Jun. '47), 14100 South Dearborn St., Riverdale, Ill.

LEE, HOWARD AUGUSTUS (Assoc. M. '47), Asst. Engr. of Design, Hudson & Manhattan R.R. Co., 30 Church St., New York 7, N.Y. (Res., 106 University Ave., Metuchen, N.J.)

LUEDEKING, ERNEST WILLIAM (Jun. '47), Engr., United Steel Fabricators (Res., 535 East North), Wooster, Ohio.

MAC RAE, WILLIAM BALE (Assoc. M. '46), Associate Hydr. Engr., Federal Power Comm., 610 South Canal St., Chicago 7 (Res., 3624 Prairie Ave., Brookfield), Ill.

MCCALLUM, HUGH HAYNESWORTH, JR. (Jun. '46), Architectural Draftsman, James A. Stripling, A.I.A., Care, J. A. Stripling, Child Bldg., Tallahasse, Fla.

MCNAMARA, EDWARD JOSEPH (Assoc. M. '47), Supervisor of Constr., Freeport Sulphur Co. (Res., Box 19), Port Sulphur, La.

MCQUEEN, HOWARD RENTON (M. '47), Eng. Dept., City of San Diego, Civic Center (Res., 5051 University Ave.), San Diego 5, Calif.

MENDLOWITZ, SAMUEL (Jun. '47), 29 Scholes St., Brooklyn 6, N.Y.

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MICK, KERWIN LEWIS (Assoc. M. '47), Chf. Engr. & Supt., Minneapolis-St. Paul San. Dist., P. O. Box 3598 (Res., 639 East 57th St.), Minneapolis 7, Minn.

MILAEGER, RALPH EUGENE (Jun. '47), Dist. Engr., Layne-Pacific, Inc., 601 Dexter-Horton Bldg., Seattle, Wash.

MILLER, EDWARD HENRY (Jun. '47), Teaching Asst., Graduate Student in Civ. Eng., Carnegie Inst. of Tech., Pittsburgh, Pa.

MITCHELL, MAURICE DALE (Jun. '47) (Carson-Mitchell), 410 Land Bank Bldg., Springfield, Mo.

MONTEALEGRE, FEDERICO JIMENEZ (Assoc. M. '47), Gerente, (Federico Jimenez y Co. Ltda.), Ave. la. entre Calles 4 y 6 (Res., Gran Hotel Costa Rica, P. O. Box 527), San Jose, Costa Rica.

MORETTO, ORESTE (Jun. '46), Foundation Engr., Administracion General de Vialided National, San Martin 871, Buenos Aires (Res., M. J. Haedo 2938, Florida, F.C.C.A.), Argentina.

MOWRY, GEORGE ALBERT, JR. (Assoc. M. '47), Engr., Okes Constr. Co., 1501-E First National Bank Bldg., St. Paul 1, Minn.

NEHF, ANDREW JAMES (M. '46) Cons. Engr. (Andrew J. Nehf-Civ. Engr.), 2632 Farrington, Terre Haute, Ind.

NEWBERRY, JAMES ALVIN (Jun. '47), Junior Engr., Wilson and Co., Engrs., 223 North Santa Fe, Salina, Kans.

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OLIVERO, HUMBERTO, JR. (Jun. '47), Chf. Design Engr., Servicio Cooperative Intermericano de Salud Publica, 6 a A.S. 54 (Res., 3 a A.S. 20), Guatemala City, Guatemala.

ORCUTT, RICHARD GATTON (Jun. '46), Asst. Engr., Creole Petroleum Corp., Apartado 35, Barcelona, Venezuela.

PAYNE, HARRY DANIEL (M. '47), Archt. and Engr., 120 Studio Bldg., 3908 South Main St., Houston 14, Tex.

PELLETIER, CHARLES JAMES (Jun. '47), Instr. in Mech. Eng., Univ. of Connecticut, Storrs, Conn.

PETRY, NICHOLAS ROBERT (Assoc. M. '47), Partner & Gen. Supt., N. G. Petry Const. Co., 3144 Navajo St., Denver 11, Colo.

PHILLEO, ROBERT EUGENE (Jun. '47), Asst. Engr., Portland Cement Assn., 33 West Grand Ave., Chicago 47, Ill.

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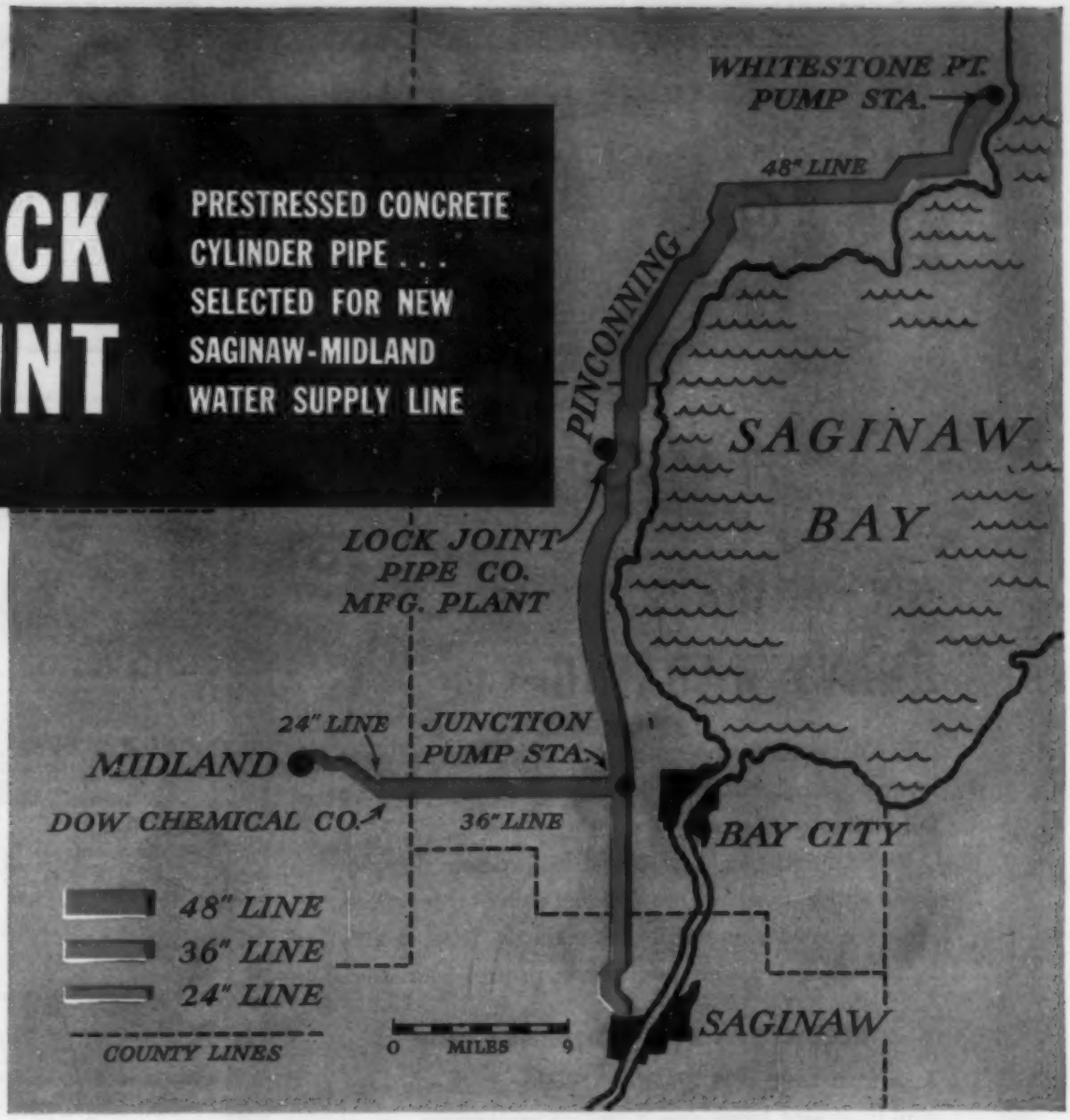

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RAMPE, DAVID ALFRED (Jun. '46), Draftsman, Carnegie-Illinois Steel Corp., 3428 East 89th St. (Res., 4920 Rhodes Ave.), Chicago 19, Ill.

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SCHAFFER, HENRY FRANCIS (Assoc. M. '46), Structural Engr., Gulf Oil Corp., 410 Gulf Bldg., Pittsburgh (Res., 729 Washington Ave., Carnegie), Pa.

SCHINDLER, RICHARD RUDOLF (Jun. '47), Graduate Student of Civ. Eng., Univ. of California (Res., 2432 College Ave.), Berkeley 4, Calif.

SCHWARTZ, MILTON (Jun. '47), Junior Civ. Engr. & Draftsman, Howard, Needles, Tammen & Bergendoff, 55 Liberty St. (Res., 43 Sickles St.), New York 34, N.Y.

SHOBER, WILLIAM BRIDGEFORD (Assoc. M. '47), Sales Engr., Armco International Corp., Middletown, Ohio.

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SMITH, ALBERT GORDON (Assoc. M. '47), Civ. Engr., Tenn. Valley Authority, Box 911, Elizabethton (Res., 211 Oak St., Johnson City), Tenn.

SMITH, MARVIN LUKE (Assoc. M. '47), San. Eng. Consultant, U.S. Public Health Service, 2 Park Ave., New York 16, N.Y. (Res., 513 Bishopthorpe St., Bethlehem, Pa.)

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STACEY, WILLIAM ARTHUR, III (Jun. '47), Civ. Engr., State Highway Comm., State Highway Div., Topeka (Res., 1939 New Hampshire, Lawrence), Kans.

STEPHENSON, THOMAS JAMES (M. '47), Senior Civ. Engr., City of Portland, Room 401, City Hall (Res., 3245 North East 47th Ave.), Portland 13, Ore.

STRIEKERT, ROY ROBERT (Assoc. M. '47), Chf. Draftsman, Civ. Eng. Dept., Gulf Oil Corp., P. O. Drawer 2100, Houston 1, Tex.

STUDLEY, ELBRIDGE GERRY (M. '47), Senior Civ. Engr., Bureau of Eng., City of Los Angeles, 708 City Hall (Res., 5127 Victoria Ave.), Los Angeles 43, Calif.

TAM, JAMES SAU KEONG (Jun. '47), Designing Structural Draftsman, E. B. Badger & Sons Co., 75 Pitts St., Boston 14 (Res., 24 Mellen St., Cambridge), Mass.

TOENNIES, ADLAI KOPP (Assoc. M. '47), Engr. of Design, The Refinery Eng. Co., 600 South Michigan Ave., Chicago 5, Ill.

VON SEGGERN, MARVIN EMIL (Assoc. M. '47), Office Engr., U.S. Bureau of Reclamation, Box 297 (Res., 1702 East Humbolt St.), Pierre, S.Dak.

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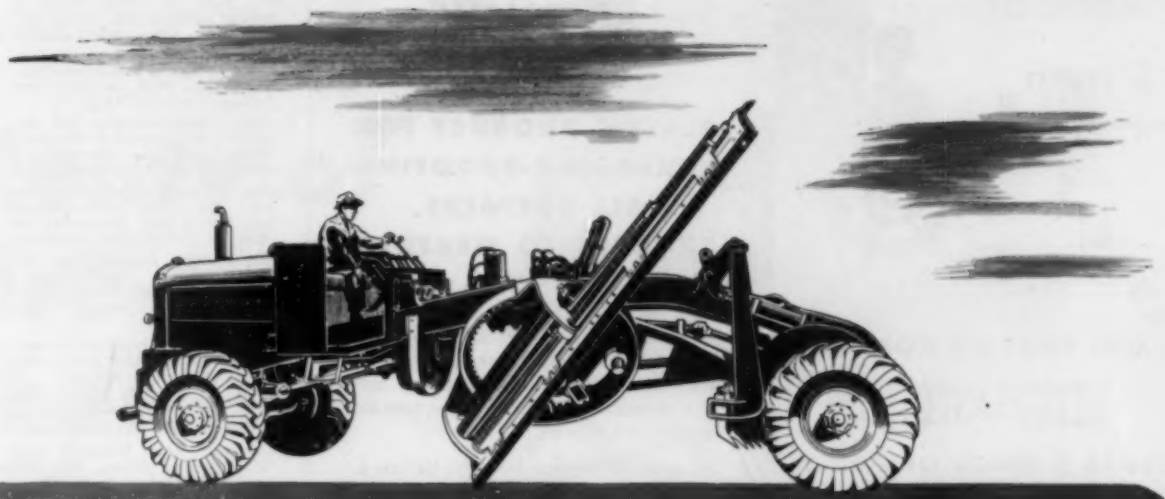

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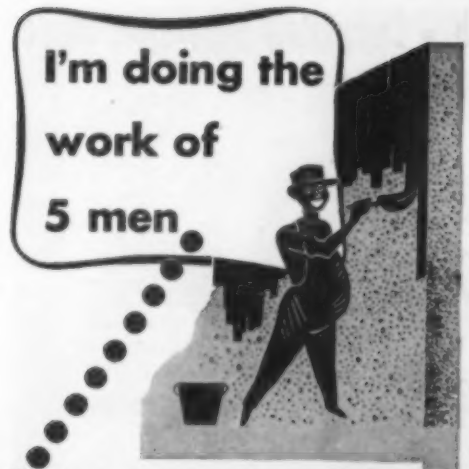

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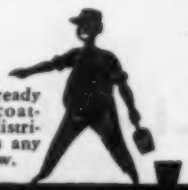

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BOTTOMS, ERIC EDMUND (Jun. '30; Assoc. M. '38; M. '47), Chf., Investigation Branch, River and Harbor Board, T-7, Gravelly Point (Res., 2619 North Pocomoke St.), Washington, D.C.

BRUNK, GUY GEORGE (Jun. '34; Assoc. M. '47), Service Engr., Great Lakes Steel Corp., 3750 Penobscot Bldg., Detroit, Mich. (Res., 1616 Forest, Waterloo, Iowa.)

BUDNIK, CASS A. (Assoc. M. '41; M. '47), Project Mgr., Maxor Constr. Co., Inc., P. O. Box 72, Miamisburg, Ohio.

BUMEN, CLARENCE WILLARD (Jun. '36; Assoc. M. '47), Gen. Constr. Supt., Federal Constructors, Inc., 407 South Dearborn St., Chicago 5 (Res., Route 1, Antioch), Ill.

CANALS, JOSE MANUEL (Jun. '27; Assoc. M. '30; M. '47), Civ. Engr., Box 1185, San Juan 6, Puerto Rico.

CARNIGLIA, JOSEPH WILLIAM (Jun. '40; Assoc. M. '47), Chf., Hydrology Section, Project Planning, U.S. Bureau of Reclamation, Box 302, Chico, Calif.

COLLIE, ROBERT MONROE (Jun. '40; Assoc. M. '46), Designing Engr., Freese, Nichols & Turner, 11th Floor, United Gas Bldg. (Res., 7426 Magnolia St.), Houston 12, Tex.

CONRAD, RAYMOND FOSS (Jun. '34; Assoc. M. '47), Constr. Supt., Atlantic Bitulithic Co., Munsey Bldg., Washington, D.C. (Res., 4701 Calvert Rd., College Park, Md.)

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CROSS, OSCAR REEVES, JR. (Jun. '36; Assoc. M. '46), Engr., The Pacific Telephone & Telegraph Co., Room 528, 88 Second St., San Francisco (Res., 3122 Eton Ave., Berkeley 5), Calif.

CUMMINS, NEIL JOSEPH (Jun. '39; Assoc. M. '47), Associate Civ. Engr., City of Los Angeles, Treatment Plant Design, Room 708 City Hall, Los Angeles (Res., 6822 Gifford Ave., Bell), Calif.

DEAN, ANTHONY PORTER (Assoc. M. '29; M. '47), Regional Engr., U.S. Forest Service, 630 Sansome St., San Francisco 8, Calif.

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HERTENSTEIN, WESLEY CHARLES (Jun. '26; Assoc. M. '35; M. '46), Supt. of Buildings & Grounds, California Inst. of Technology, 1201 East California St., Pasadena 4, Calif.

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KOESSNER, ERWIN (Jun. '34; Assoc. M. '46) Office Engr., U.S. Bureau of Reclamation, Box 1259, Idaho Falls, Idaho.

LABELLE, WALTER ERNEST (Jun. '30; Assoc. M. '37; M. '46), Asst. to Gen. Mgr., Fabricated Steel Constr., Bethlehem Steel Co., Bethlehem, Pa.

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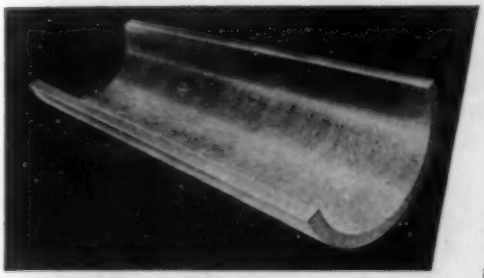

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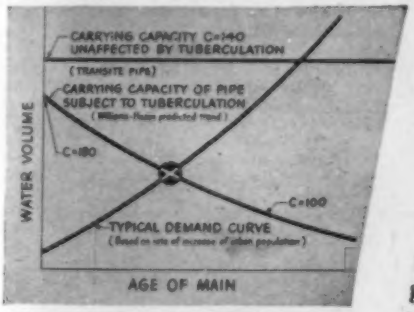

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Morrison, Walter Gordon (Jun. '27; Assoc. M. '32; M. '46) (Morrison, Mitchell & Mitchell, Civ. & Structural Engrs.), National Bank Chambers, Wellington, C.I., New Zealand.

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Severud, Fred Nicholas (Jun. '24; Assoc. M. '28; M. '47) Cons. Structural Engr. (Fred N. Severud, Cons. Engr.), 415 Lexington Ave., New York, N.Y.

Siess, Chester Paul (Jun. '36; Assoc. M. '47) Special Research Asst. Prof. of Theoretical & Applied Mechanics, Univ. of Illinois, 103 Talbot Laboratory, Urbana, Ill.

Sitler, Willard Stanley (Jun. '39; Assoc. M. '47) San. Engr. (Asst. to Dist. Engr.), Bureau of Eng., State Dept. of Health, Room 609, Trust Bldg., Meadville, Pa.

Sloane, Richard, Lewis (Jun. '43; Assoc. M. '47) Associate Prof., Civ. Eng., Univ. of Utah, Salt Lake City 1, Utah.

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Spade, Walter Emmett (Assoc. M. '44; M. '47) Structural Engr. Staff, Kimberly-Clark Corp., Kimlark Office (Res., 349 East Franklin Ave.), Neenah, Wis.

Spelman, Malcolm Steward (Jun. '24; Assoc. M. '33; M. '47) Asst. Engr., Specifications, The Port of New York Authority, 111 Eighth Ave., New York 11 (Res., 5 Kenwood Court, Rockville Centre), N.Y.

Spero, Michael Anthony (Jun. '34; Assoc. M. '47) Associate Structural Engr., Bureau of Reclamation, Denver, Colo. (Res., 25 Hall Ave., Newport, R.I.)

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Wise, Lauress Lee (Jun. '41; Assoc. M. '47) Asst. Editor, *Eng. News-Record*, McGraw-Hill Publishing Co., 68 Post St., San Francisco 4, Calif.

Yoder, Charles William (Jun. '35; Assoc. M. '47), Structural Engr., Portland Cement Assn., 735 North Water St., Milwaukee, Wis.

Young, Lewis Alaric (Jun. '35; Assoc. M. '39; M. '47) Associate Chf. of Party & Chf. Engr., Div. of Health & Sanitation, Inst. of Inter-American Affairs, Apartado Aereo 3951, Bogota, Colombia, S.A.

Reinstatements

Adiran, George Washington, Jun., 904 North Hendricks St., Montebello, Calif., reinstated Feb. 25, 1947.

Bennett, Robert Henry, Assoc. M., 29 West Andrews Drive, Atlanta, Ga., reinstated Feb. 25, 1947.

Bowie, Nathaniel Mortimer, M., Chf. Engr., Thomas Bryan & Associates, Inc., P. O. Box 895 (Res., 1300 Myrtle Blvd.), Lafayette, La., readmitted Feb. 10, 1947.

Cobb, Guy Williams, M., Engr. of Surveys, State Highway Dept., Little Rock, Ark., readmitted Feb. 10, 1947.

Dading, Charles Henry, M., 423 Rosebank Ave., Baltimore 12, Md., reinstated Mar. 10, 1947.

Flint, Lawrence Lowell, Assoc. M., Box 495, Sanborn, Iowa, reinstated Feb. 21, 1947.

Kane, John Edmund, M., Civ. Engr., Standard Brands, Inc., Charles Point, Peekskill, N.Y., readmitted Feb. 10, 1947.

Kaufman, Herbert Leonard, Jun., 125 Columbia Ave., Passaic, N.J., reinstated March 4, 1947.

Nesto, Raymond Rocco, Jun., 872 Broadway, Newark 4, N.J., reinstated Feb. 28, 1947.

O'Toole, John Edward, Assoc. M., 706 Watts Bldg., Birmingham 3, Ala., reinstated Feb. 13, 1947.

Pierleoni, Carl, Assoc. M., 11 Overman Place, New Rochelle, N.Y., reinstated Feb. 25, 1947.

Robins, George Patrick, Assoc. M., Design Engr. Phillips Petroleum Co., 200 Osage (Res., 1517 Hickory), Bartlesville, Okla., reinstated Dec. 16, 1946.

Rubins, Ralph Edward, M., 917 Forest Ave., Evanston, Ill., reinstated Jan. 13, 1947.

Saxton, Ren George, M., Head., Dept. of Civ. Eng., Div. of Eng., Oklahoma Agri. and Mech. College, Stillwater, Okla., reinstated Feb. 21, 1947.

Ustel, Sabih Aziz, Jun., Posta Kutusu 37 Hazakal Insaat Sviketi, Eskisehir, Turkey, reinstated Feb. 25, 1947.

Willis, Charles Leyton, Jr., Assoc. M., 3029 El Campo, Fort Worth, Tex., reinstated Mar. 3, 1947.

Woodward, Harold Stone, Jun., 138 Rockland Ave., Larchmont, N.Y., reinstated Feb. 25, 1947.

Resignations

Dunham, Frank Cromie, Jun., 234 Pharr Road, Atlanta, Ga., resigned Feb. 25, 1947.

Evans, Henry Pritchard, Jr., Assoc. M., Maj., Corps of Engrs., U.S. Army, 179 Herrick Rd., Riverside, Ill., resigned Feb. 18, 1947.

Greulich, Bernard James, Jun., 1299 Bush St., San Francisco, Calif., resigned Feb. 6, 1947.

Goebert, Walter Glenn, Jun., 453 West Marquette Rd., Chicago, Ill., resigned Feb. 6, 1947.

Heselton, Frank Richmond, Assoc. M., U.S. Engr. Office, Sault Ste. Marie, Mich., resigned Feb. 11, 1947.

Hodges, Richard McKandlish, M., 1304 Langhorne Road, Lynchburg, Va., resigned Feb. 6, 1947.

Krocker, Robert Adolph, Jun., 402 West Gramercy Pl., San Antonio, Tex., resigned Feb. 25, 1947.

Meggitt, Samuel Edward, Assoc. M., 319 Colchester Rd., Ipswich, Suffolk, England, resigned Dec. 31, 1946.

Neubauer, Fred William, Jun., 112 East Boyd St., Dixon, Ill., resigned Feb. 26, 1947.

Oliver, Elmer Lewis, Assoc. M., 33 Greenview Drive, Rochester 7, N.Y., resigned Dec. 31, 1946.

Patterson, Virgil Gibney, Jun., 382 Whitney Ave., New Haven, Conn., resigned Feb. 25, 1947.

Radcliffe, Jack Clifford, Jun., 143 Acres Drive, Hamilton Square, N.J., resigned Dec. 31, 1946.

Rothgery, Lee Joseph, M., Mariposa Rd., Lafayette, Calif., resigned Feb. 25, 1947.

Schrader, Otto Harry, Jr., Assoc. M., Univ. of Washington, Seattle, Wash., resigned Feb. 14, 1947.

Semsen, Arthur Andersen, Assoc. M., 369 Pine St., San Francisco, Calif., resigned Dec. 31, 1946.

Van Breda, Anthony Jean, Jun., 3141 South 6th St., Springfield, Ill., resigned Feb. 10, 1947.

Vander Velde, Theodore Louis, Assoc. M., 2609 East Saginaw St., Lansing 12, Mich., resigned Dec. 31, 1946.

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